HS No. 636732

REPORT NUMBER 216-GTL-03-004

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 216 ROOF CRUSH RESISTANCE

GENERAL MOTORS CORPORATION
2003 CHEVROLET TRAILBLAZER, MPV
NHTSA NO. C30107

GENERAL TESTING LABORATORIES, INC.
1623 LEEDSTOWN ROAD
COLONIAL BEACH, VIRGINIA 22443

AUGUST 19, 2003

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
SAFETY ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET, SW
ROOM 6111 (NVS-220)
WASHINGTON, D.C. 20590

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Prepared By: Debbie Messich

Approved By: [illegible]

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15. Supplementary Notes

16. Abstract

Compliance tests were conducted on the subject, 2003 Chevrolet Trailblazer MPV in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-216-05 for the determination of FMVSS 216 compliance.
Test failures identified were as follows:
NONE

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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2003 Chevrolet Trailblazer MPV was subjected to Federal Motor Vehicle Safety Standard (FMVSS) No. 216 testing to determine if the vehicle was in compliance with the requirements of the standard. The purpose of this standard is to reduce deaths and injuries due to the crushing of the roof into the occupant compartment in rollover crashes.

1.1 The test vehicle was a 2003 Chevrolet Trailblazer MPV. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: 1GNDT13SX32213808

B. NHTSA No.: C30107

C. Manufacturer: GENERAL MOTORS CORPORATION

D. Manufacture Date: 11/02

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 216 testing on July 28, 2003.

SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

2.0 TEST RESULTS

All tests were conducted in accordance with NHTSA, Office of Vehicle Safety Compliance (OVSC) Laboratory Procedure, TP-216-05 and General Testing Laboratories Procedure, TP-216-05B with the following modifications requested by the COTR:

1) The vehicle was rigidly mounted in the test fixture by welding vertical supports to the vehicle jack points to prevent any vehicle movement. Chains were not used in an effort to reduce and/or eliminate "pre-stressing" of the vehicle due to the tightening of chains.

2) Dial gauges were placed at the vehicle corners and at the passenger door to track overall vehicle motion and the ability of the alternate tie-down procedure to restrict motion of the vehicle.

3) String potentiometers were placed at the driver's designated seat position and attached to the interior surface of the roof above a normally positioned 50th percentile Hybrid III ATD head. The string potentiometers tracked the interior motion of the roof.

4) Performed the roof crush test to a loading ram displacement of 127 mm or 44,482 N force, whichever comes first.

The data for this portion of the test can be found on Data Sheets 6 and 7.

Based on the test performed, the 2003 Chevrolet Trailblazer appears to meet the requirements of FMVSS 216 testing.

SECTION 3

COMPLIANCE TEST DATA

3.0 TEST RESULTS

The following data sheets document the results of testing on the 2003 Chevrolet Trailblazer.

DATA SHEET 1
FMVSS 216
SUMMARY OF RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2003 CHEVROLET TRAILBLAZER MPV
VEH. NHTSA NO: C30107; VIN: 1GNDT13SX32213808
VEH. BUILD DATE: 11/02 ; TEST DATE: JULY 28, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

A. VISUAL INSPECTION OF TEST VEHICLE

Upon receipt, inspect vehicle for completeness, function, and discrepancies or damage which might influence the testing.

RESULTS:

B. VEHICLE DATA

(1) Vehicle type as shown on certification label: MPV
(2) Vehicle UVW as recorded on Data Table 2: 2018.6 kg

C. STATIC LOAD TEST OF DRIVER SIDE OF ROOF

Minimum roof crush resistance required by FMVSS 216 for the vehicle tested:

MCCR as recorded on Data Table 2: 29,673 N

	PASS	FAIL
Maximum roof crush resistance measured during test was 42,808 N at 72.4 mm	X	

D. POST TEST VISUAL INSPECTION

Flattened area on roof on driver's side from "A" pillar to "C" pillar approximately 1500 mm long x 650 mm wide. Windshield shattered, driver door glass shattered, driver's "A" pillar and "B" pillar are bent.

RESULTS:

REMARKS:

RECORDED BY: G. Farrand DATE: 07/28/03
APPROVED BY: D. Messick

DATA SHEET 2
FMVSS 216
RECEIVING INSPECTION

VEH. MOD YR/MAKE/MODEL/BODY: 2003 CHEVROLET TRAILBLAZER MPV
VEH. NHTSA NO: C30107; VIN: 1GNDT13SX32213808
VEH. BUILD DATE: 11/02 ; TEST DATE: JULY 28, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Upon receipt, the vehicle will be examined visually for completeness, function, and damage. The roof and supporting structures such as the doors and windows should be checked for proper operation and any discrepancies which may influence the testing. The vehicle will be weighed and the minimum roof crush resistance determined.

RESULTS:

(1) Unloaded Vehicle Weight (UVW)

Left Front	550.7	kg	Left Rear	470	kg
Right Front	517.5	kg	Right Rear	480.4	kg
Front Axle	1068.2	kg	Rear Axle	950.4	kg

TOTAL UVW 2018.6 kg

(2) Vehicle type as shown on vehicle certification label: MPV

(3) Minimum Roof Crush Resistance (MCRR):

Passenger Car:

UVW x 1.5 x 9.8 = N/A N
MCRR = N/A N (UVW x 1.5 x 9.8 or 22,241 N whichever is less)

MPV, Truck or Bus:

MCRR = UVW x 1.5 x 9.8 = 29,673 N

(4) Other Comments:

REMARKS:

RECORDED BY: DATE: 07/28/03
APPROVED BY:

DATA SHEET 3
FMVSS 216
PRE-TEST PREPARATION

VEH. MOD YR/MAKE/MODEL/BODY: 2003 CHEVROLET TRAILBLAZER MPV
VEH. NHTSA NO: C30107; VIN: 1GNDT13SX32213808
VEH. BUILD DATE: 11/02 ; TEST DATE: JULY 28, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Prior to testing, the following will be accomplished:

A. Secure any convertible top, movable or removable roof structure in their weather tight positions Removed Roof Rack

B. Close all windows OK

C. Close and lock all doors OK

D. State Side of Roof Tested Driver

E. Measure the lateral angle of the test device at sufficient points to determine that it has a 25 degree (plus zero degree, minus one degree) angle 25°

F. Measure the longitudinal angle of the loading device at sufficient points to determine that is has a 5 degree (plus zero minutes, minus 20 minutes) 5°

G. The test device will initially contact the roof at 254 mm aft of windshield

H. If the test device was relocated based on the requirements of Chapter 12.3 paragraph F, describe where the test device will initially contact the roof as relocated N/A

I. Ambient temperature 51 mm from the vehicle roof in the immediate area of the test device: 27.2 degrees C.

REMARKS:

RECORDED BY: [signature] DATE: 07/28/03
APPROVED BY: D. Musick

DATA SHEET 4
FMVSS 216

VEH. MOD YR/MAKE/MODEL/BODY: 2003 CHEVROLET TRAILBLAZER MPV
VEH. NHTSA NO: C30107; VIN: 1GNDT13SX32213808
VEH. BUILD DATE: 11/02 ; TEST DATE: JULY 28, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

RESULTS: Plots of load versus displacement and time versus displacement showed that:

(1) The maximum roof crush resistance was 42,808 N at 72.4 mm
(2) The rate of loading was 5.08 mm/sec (.2 in/sec)
(3) The required roof crush resistance of 29,673 N was at 40.1 mm

REMARKS:

RECORDED BY: _____ DATE: 07/28/03
APPROVED BY: _____

DATA SHEET 5
FMVSS 216
POST TEST VISUAL INSPECTION

VEH. MOD YR/MAKE/MODEL/BODY: 2003 CHEVROLET TRAILBLAZER MPV
VEH. NHTSA NO: C30107; VIN: 1GNDT13SX32213808
VEH. BUILD DATE: 11/02 ; TEST DATE: JULY 28, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Upon completion of testing, a detailed visual inspection of the vehicle shall be made. Describe all damage and deformation that occurred during the test.

RESULTS: Flattened area on roof on driver's side from "A" pillar to "C" pillar approximately 1500 mm long x 650 mm wide. Windshield shattered, driver door glass shattered, driver's "A" pillar and "B" pillar are bent.

RECORDED BY: _____ DATE: 07/28/03
APPROVED BY: _____

DATA SHEET 6
FMVSS 216 MODIFIED PORTION PRE-TEST

VEH. MOD YR/MAKE/MODEL/BODY: 2003 CHEVROLET TRAILBLAZER MPV
VEH. NHTSA NO: C30107; VIN: 1GNDT13SX32213808
VEH. BUILD DATE: 11/02 ; TEST DATE: JULY 28, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Driver Seat Torso Angle: 24°

Driver Seat "H" Point Location at Mid Travel:
X= 260 mm aft from centerline of front outboard seat mounting bolt
Y= 203 mm inboard from centerline of front outboard seat mounting bolt
Z= 310 mm up from centerline of front outboard seat mounting bolt

Point VRL(Vertical Measurement from H-Point to Headliner): 904.2 mm
Point VRi (Vertical Measurement from H-Point to Structure Above Headliner): 924.6 mm
Point RE(Distance from H-Point to a point 112mm behind point VRi): 942.3 mm

#1 LVDT (R.F.) Length: 930 mm
#2 LVDT (R.R.) Length: 907 mm
#3 LVDT (L.R.) Length: 907 mm

Distance from LVDT #1 (R.F.) to LVDT #2 (R.R.) = 270 mm
Distance from LVDT #2 (R.R.) to LVDT #3 (L.R.) = 250 mm
Distance from LVDT #1 (R.F.) to LVDT #3 (L.R.) = 370 mm

All LVDT's are located on a 185 mm radius from a vertical line passing through the seat "H" point. Using the forward direction as 0° reference and measuring clockwise, LVDT #1 is located at 43°, LVDT #2 is located at 137° and LVDT #3 is located at 222°.

NOTES:

RECORDED BY: [signature] DATE: 07/28/03
APPROVED BY: D. Mosic

DATA SHEET 7
FMVSS 216 MODIFIED PORTION POST TEST

VEH. MOD YR/MAKE/MODEL/BODY: 2003 CHEVROLET TRAILBLAZER MPV
VEH. NHTSA NO: C30107; VIN: 1GNDT13SX32213808
VEH. BUILD DATE: 11/02 TEST DATE: JULY 28, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Maximum Load Applied = 42,808 N @ 72.4 mm
Maximum Displacement = 142.2 mm @ 33,142 N

#1 LVDT (RF) Displacement = 56.8 mm
#2 LVDT (RR) Displacement = 63.9 mm
#3 LVDT (LR) Displacement = 47.2 mm

Left Front Dial Indicator Displacement = 8.9 mm
Right Front Dial Indicator Displacement = 3.1 mm
Left Rear Dial Indicator Displacement = 22.5 mm
Right Rear Dial Indicator Displacement = 19.3 mm
Right Door Sill Dial Indicator Displacement = 0.0 mm

NOTES:

RECORDED BY: [signature] DATE: 07/28/03
APPROVED BY: D. Messick

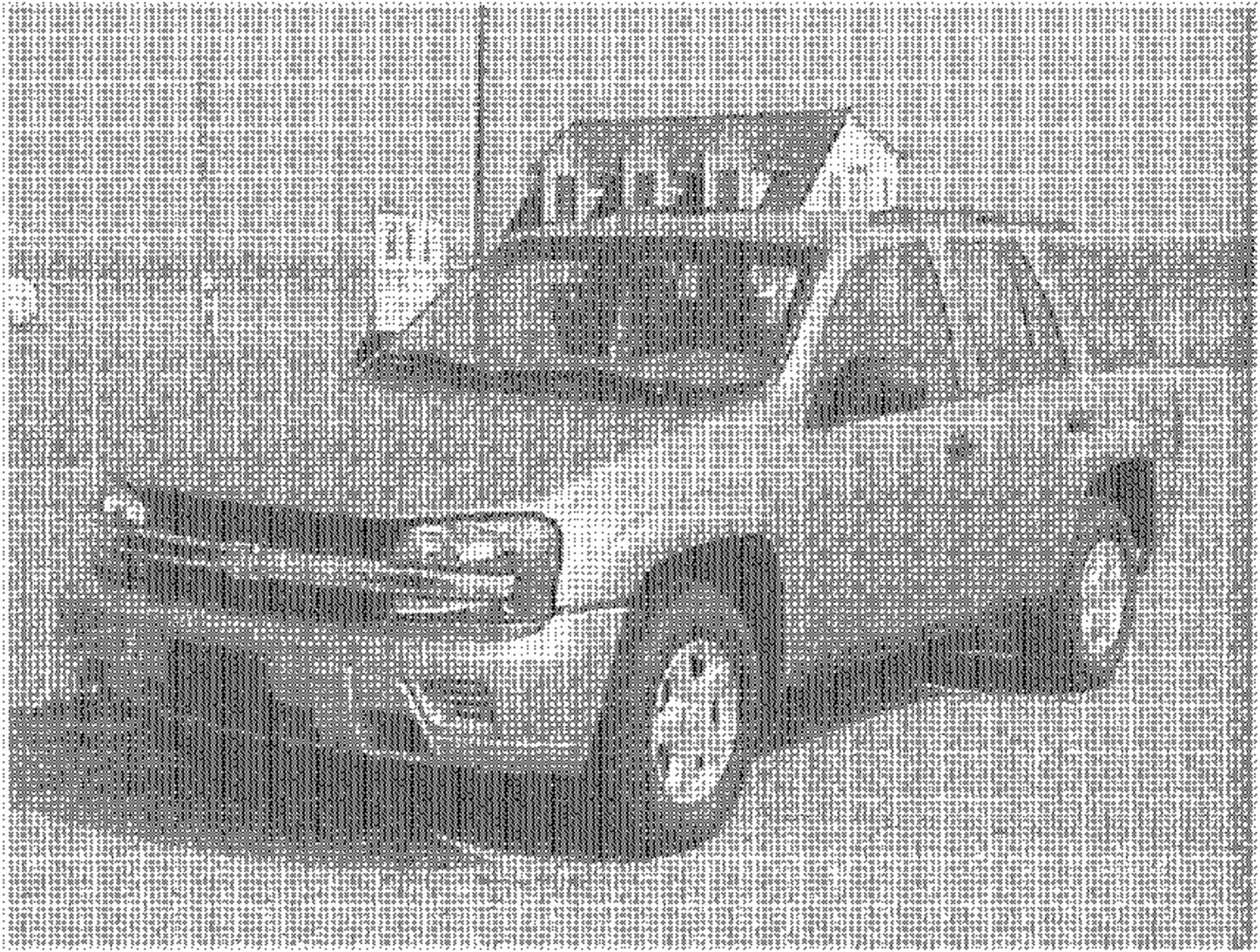
SECTION 4
INSTRUMENTATION AND EQUIPMENT LIST

TABLE 1 - INSTRUMENTATION & EQUIPMENT LIST

EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO.	CAL. DATE	NEXT CAL. DATE
COMPUTER	AT&T	486D66	BEFORE USE	BEFORE USE
TEST FIXTURE	GTL	N/A	N/A	N/A
A/D INTERFACE	METRABYTE	DAS-16(F)	BEFORE USE	BEFORE USE
SIGNAL CONDITIONER	METRABYTE	EXP-RES	BEFORE USE	BEFORE USE
LOAD CELL	REVERE	USP2/46024	06/03	06/04
DIAL INDICATOR	MITUTOYO	2424-10	BEFORE USE	BEFORE USE
LINEAR POTENTIOMETER	SERVO SYSTEMS	20/69	BEFORE USE	BEFORE USE
LINEAR POTENTIOMETER	SERVO SYSTEMS	20/70	BEFORE USE	BEFORE USE
LINEAR POTENTIOMETER	SERVO SYSTEMS	20/72	BEFORE USE	BEFORE USE
LINEAR POTENTIOMETER	ELECTRIC ASSOC. INC.	11A4A6	BEFORE USE	BEFORE USE

SECTION 5

PHOTOGRAPHS



2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 219

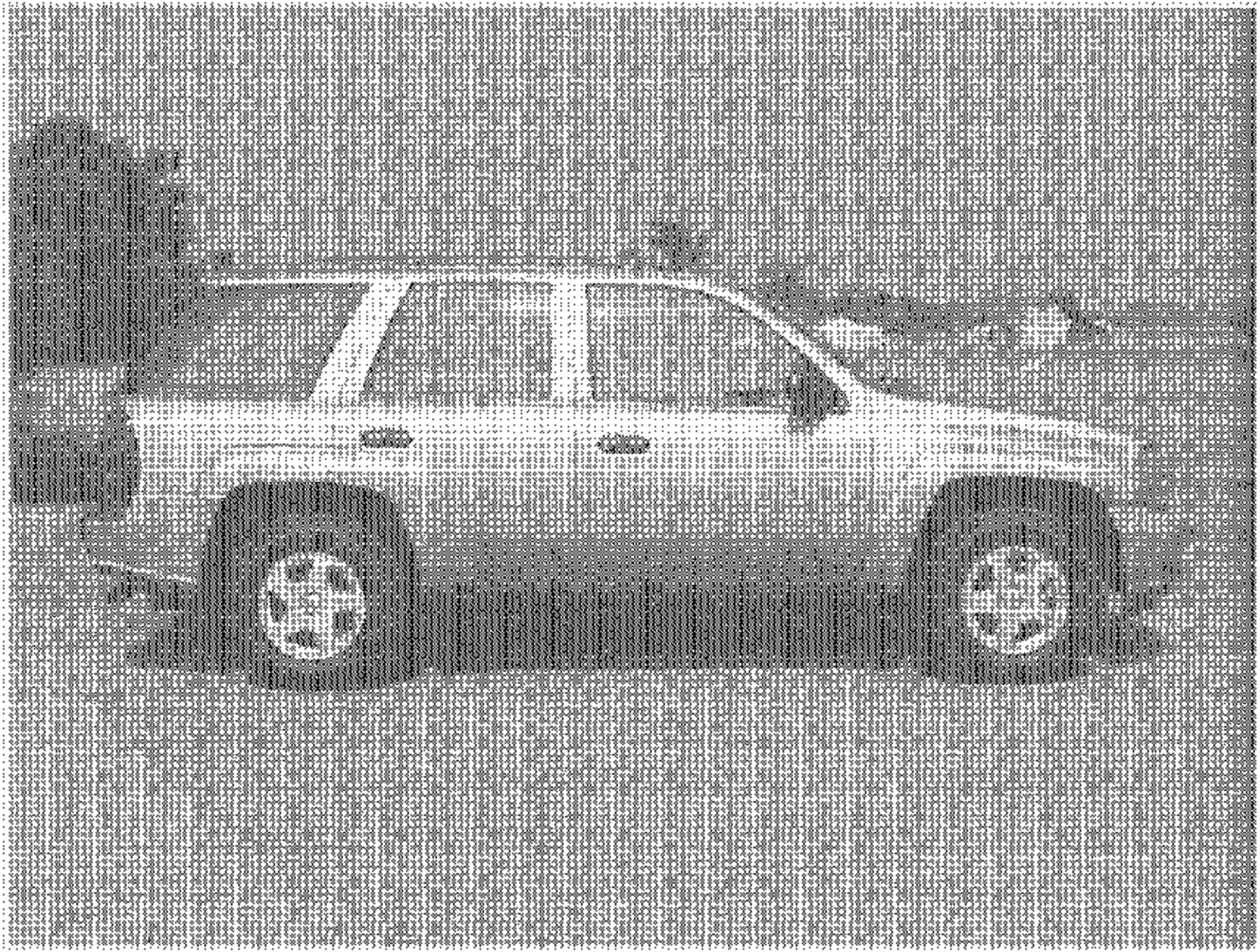
FIGURE 6-1
3/4 FORWARD VIEW OF VEHICLE ON TESTED SIDE BEFORE TESTING

2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 6.2
¾ REARWARD VIEW OF VEHICLE ON TESTED SIDE BEFORE TESTING

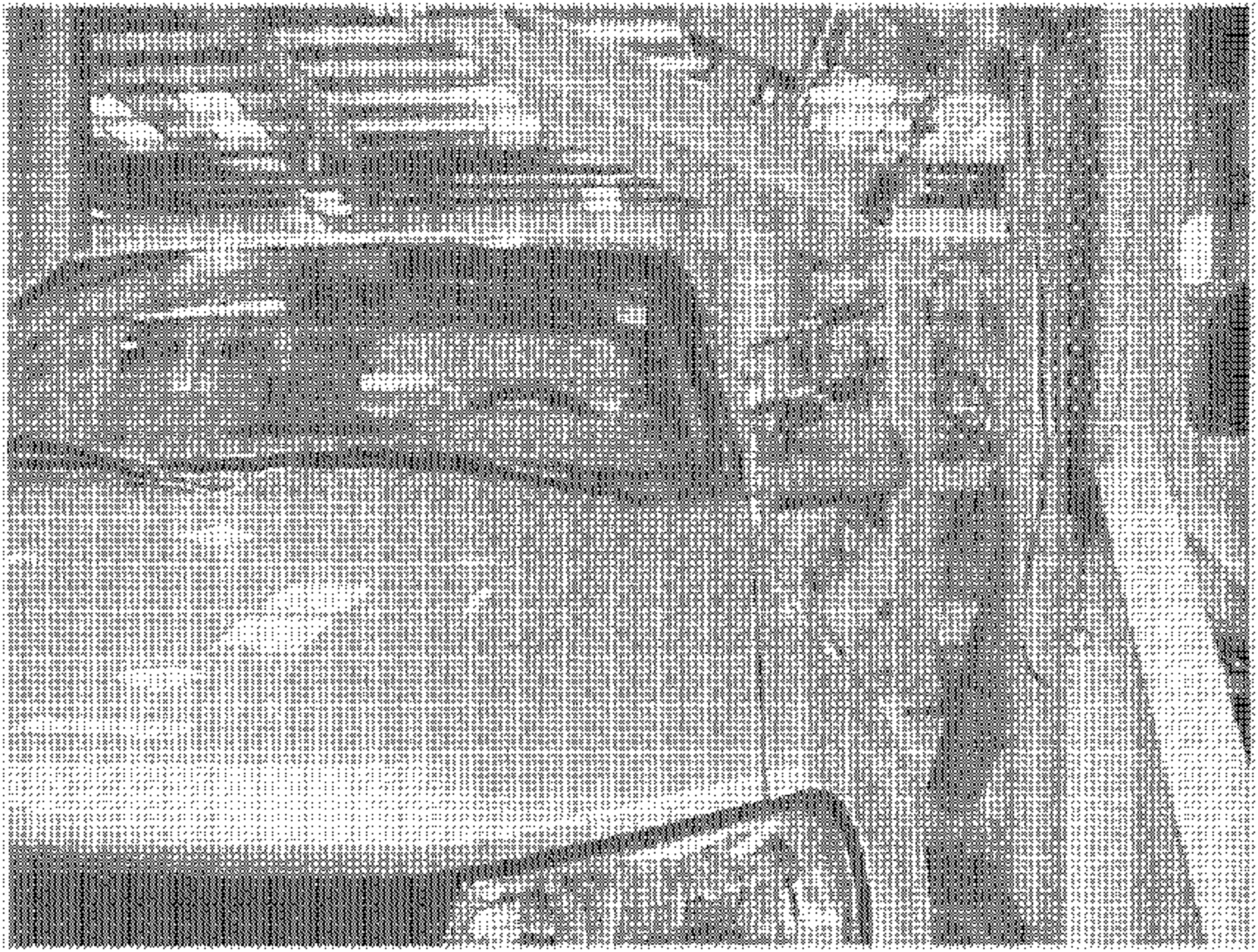
2002 CHEVROLET TRAILBLAZER
NHTSA NO. C20102
RMVIS NO. 216

FIGURE 5a
LEFT SIDE VIEW OF VEHICLE BEFORE TESTING



2003 CHEVROLET TRAILBLAZER
NHTSA NO. C20107
FMVSS NO. 216

FIGURE 5-4
RIGHT SIDE VIEW OF VEHICLE BEFORE TESTING

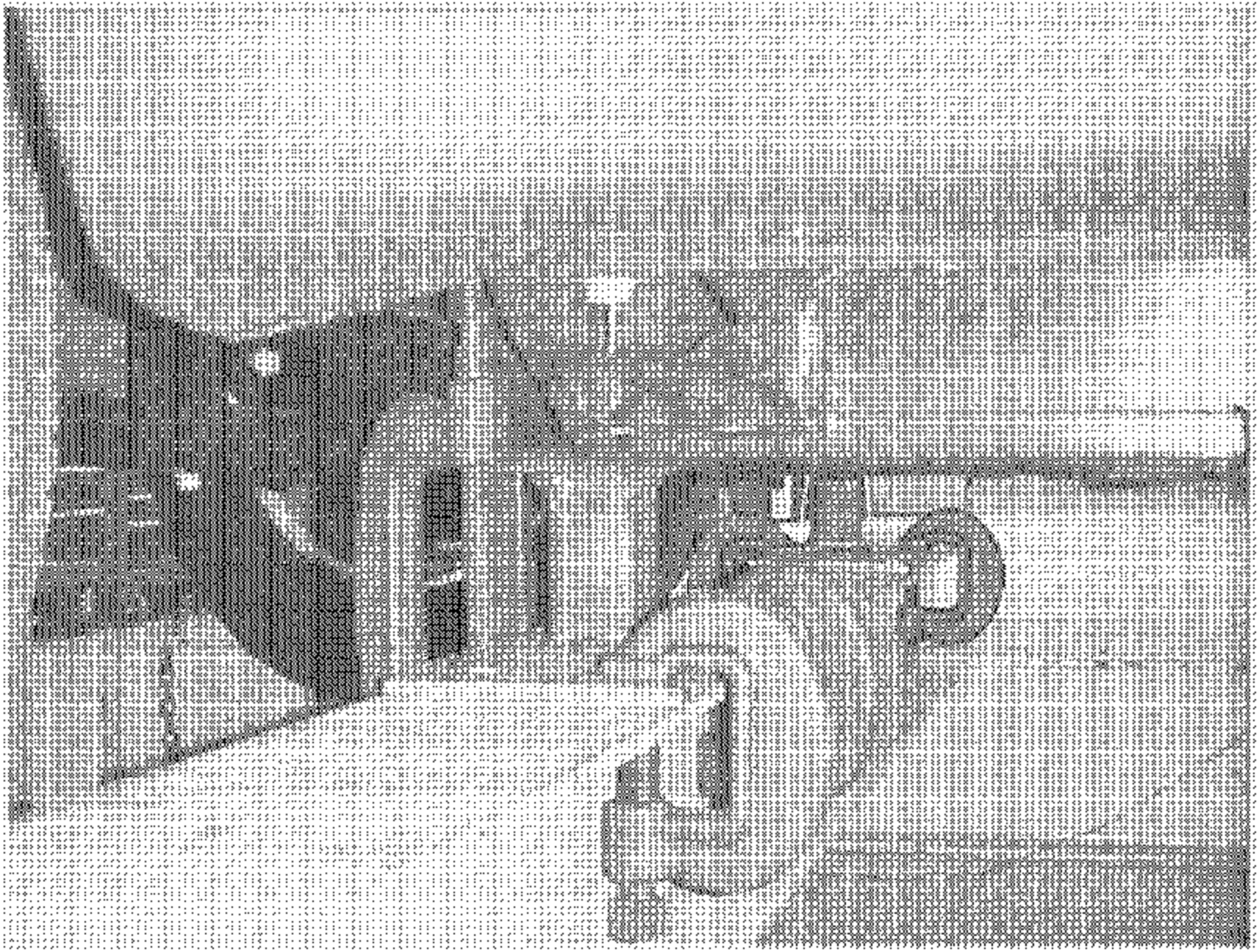


2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30102
FMVSS NO. 216

FIGURE 58
FRONT VIEW OF TEST SET-UP PRE-TEST

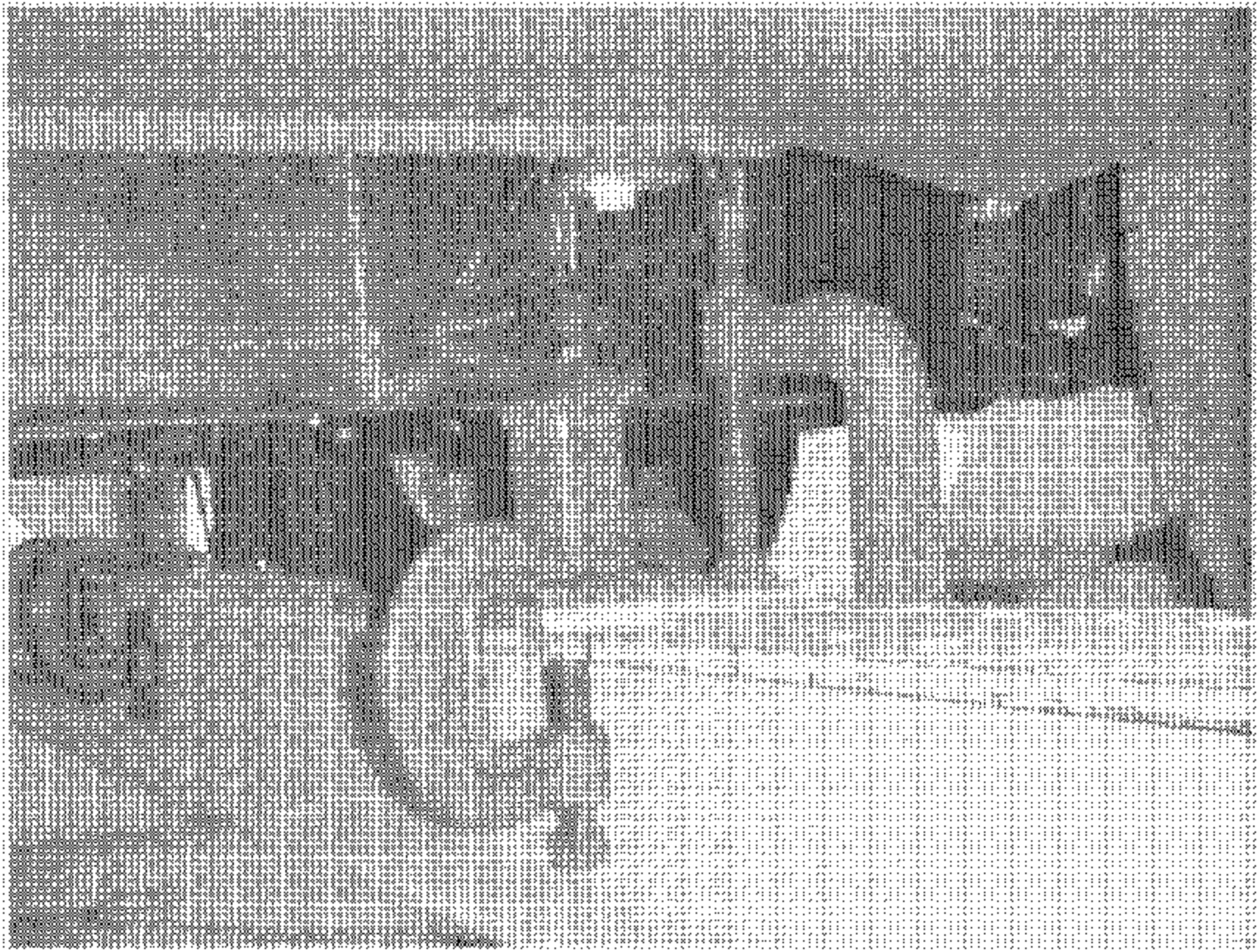
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C39107
FMVSS NO. 216

FIGURE 5.6
VEHICLE IN TEST RIG



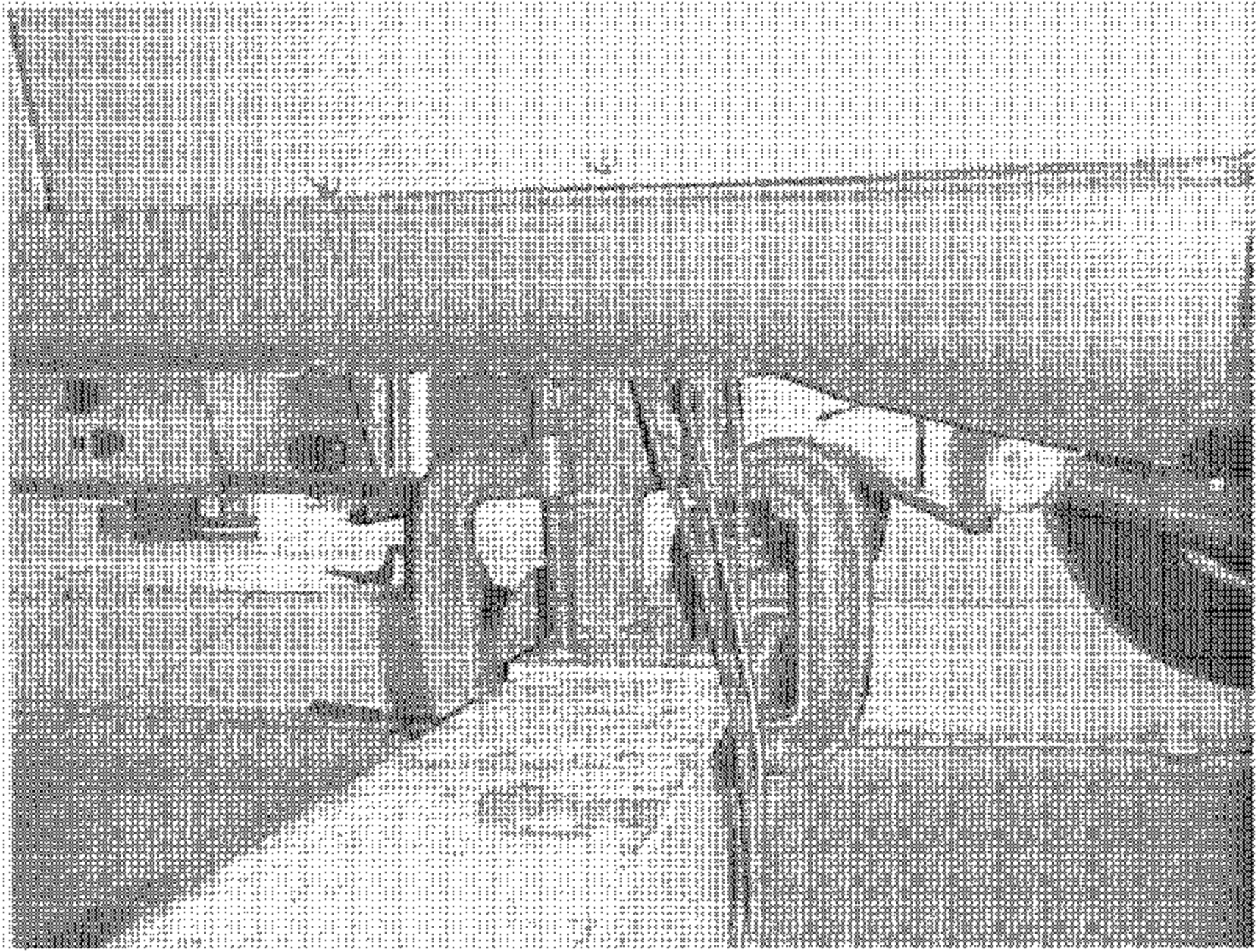
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 5-7
LEFT FRONT VEHICLE MOUNTING



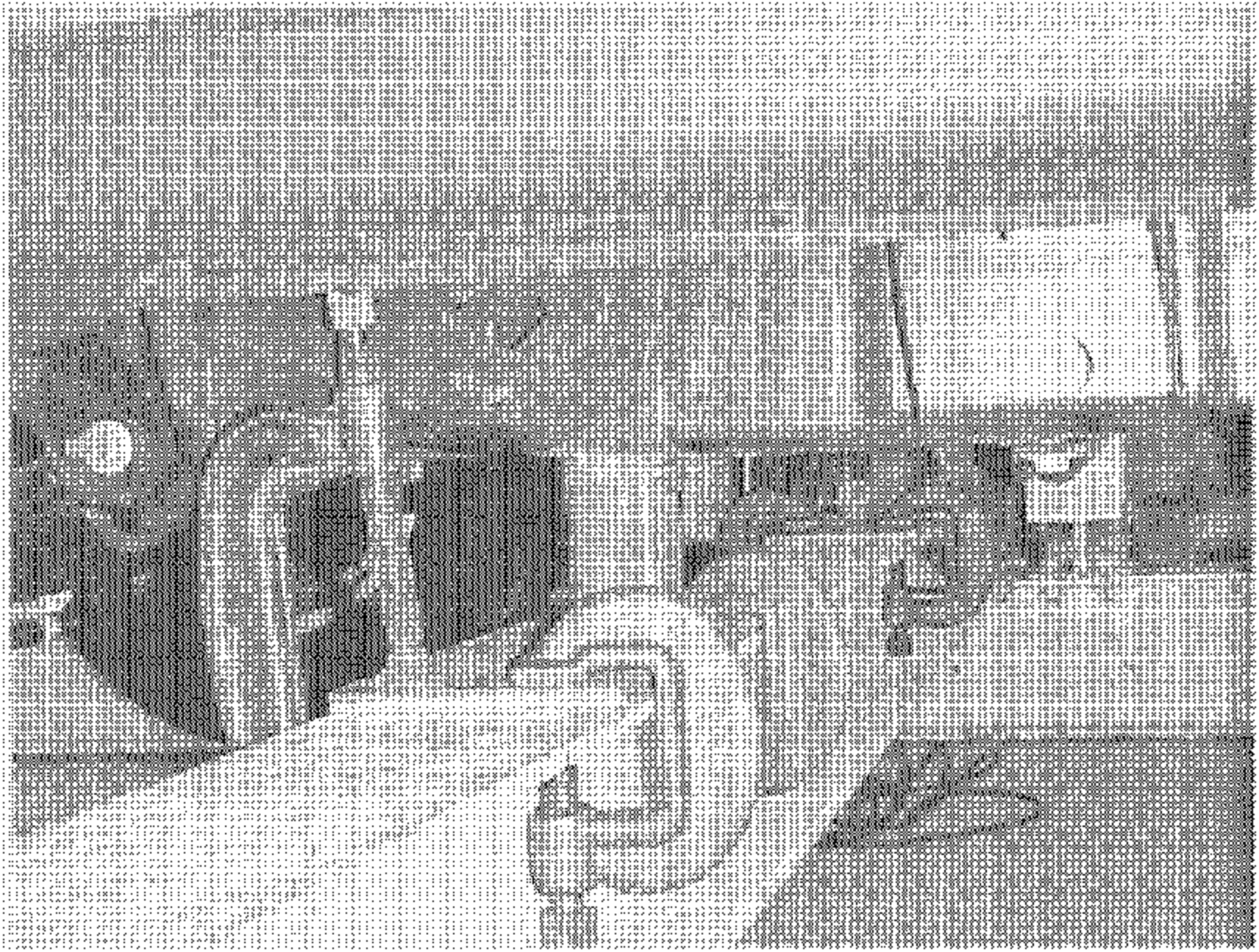
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C39167
FMVSS NO. 216

FIGURE 5.6
RIGHT FRONT VEHICLE MOUNTING



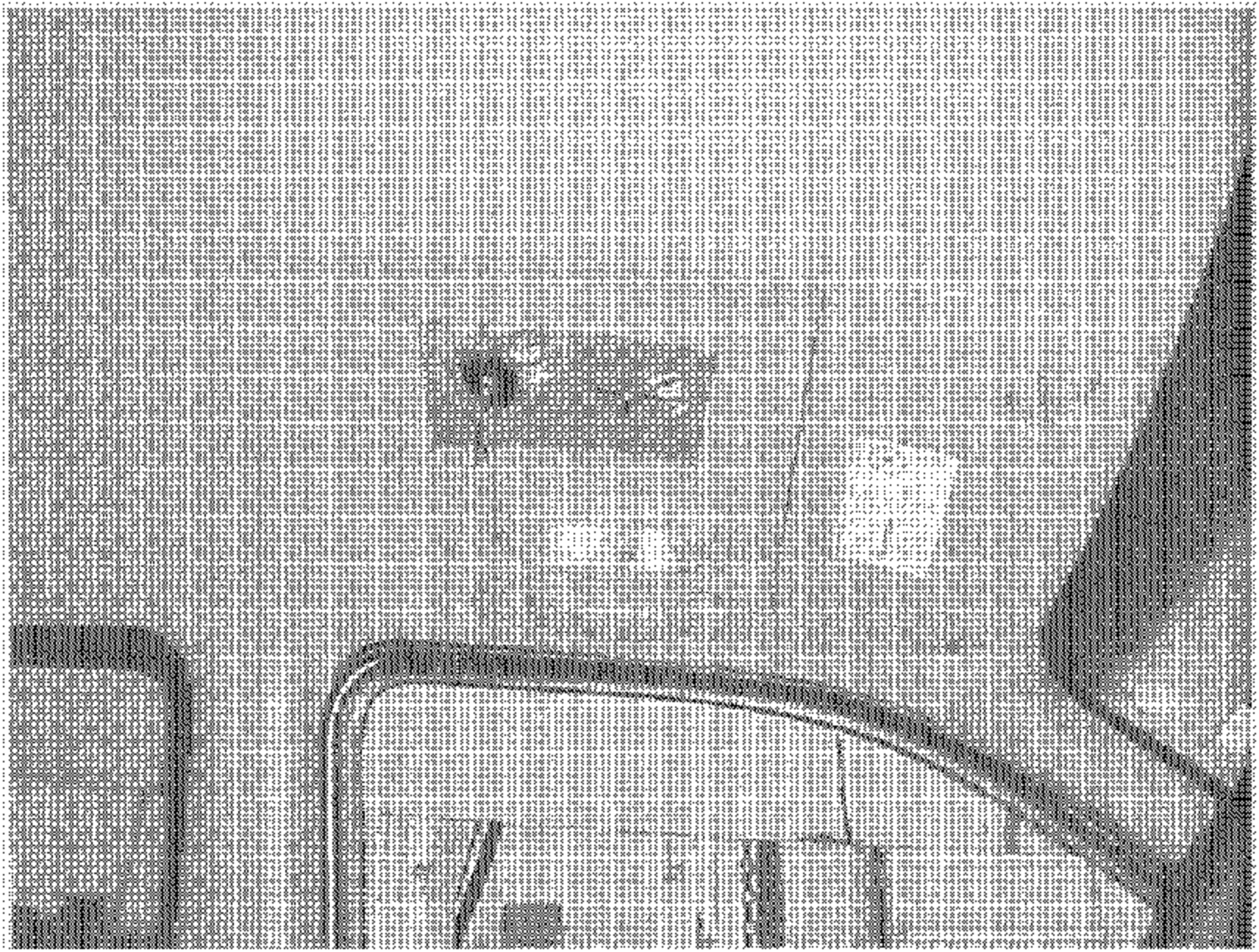
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 215

FIGURE 5-9
LEFT REAR VEHICLE MOUNTING



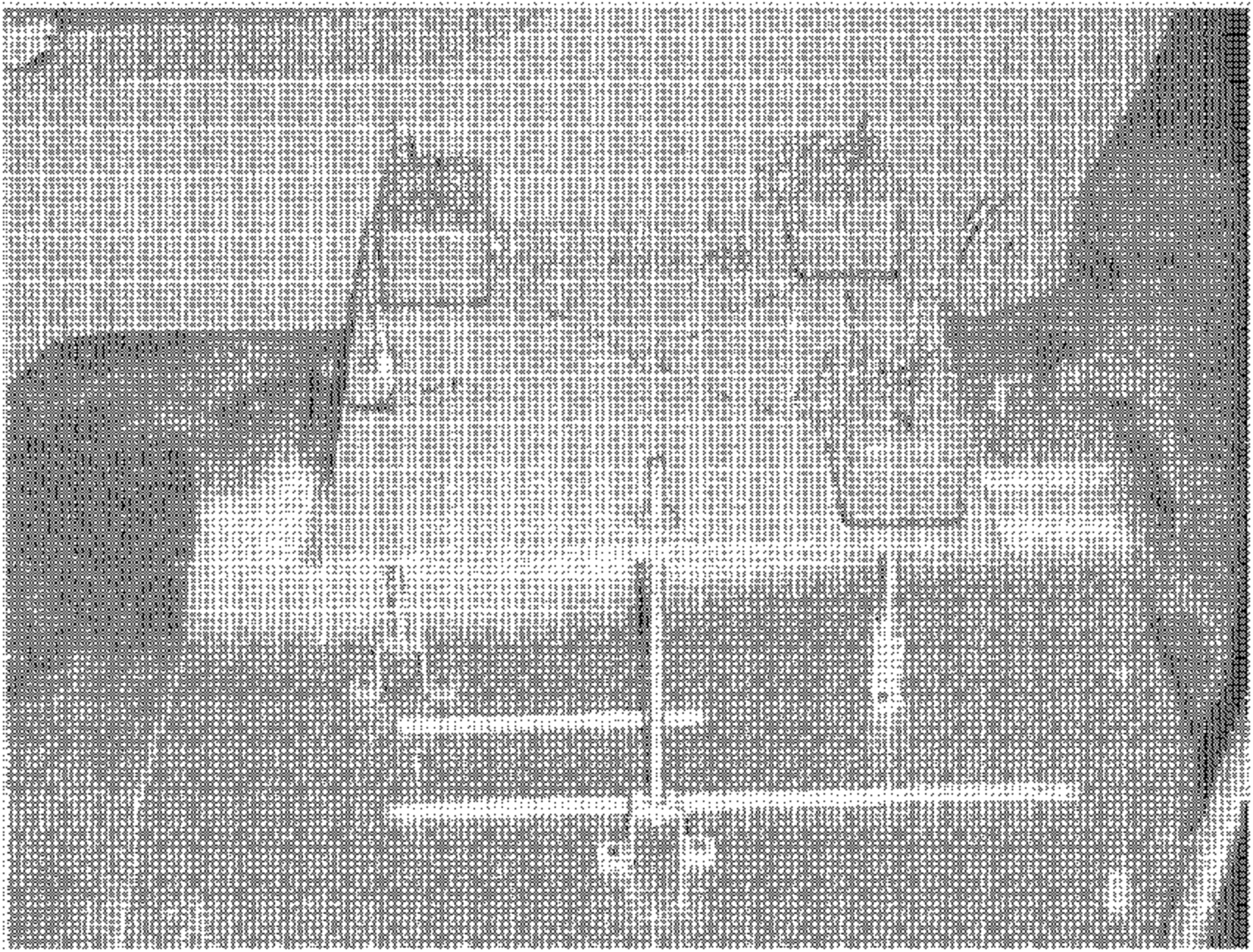
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C3016T
FMVSS NO. 215

FIGURE 5-10
RIGHT REAR VEHICLE MOUNTING



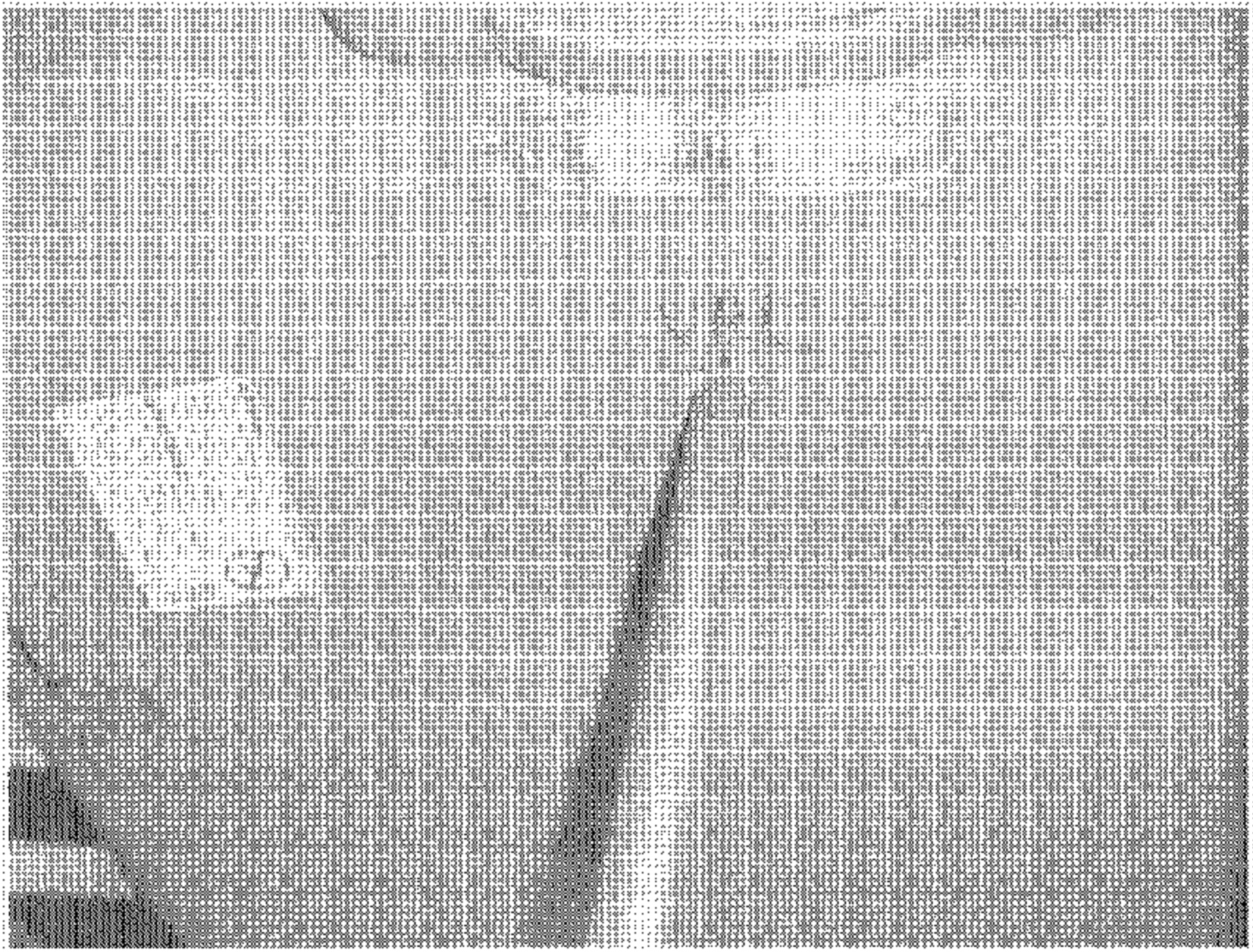
2000 CHEVROLET TRAILBLAZER
NHTSA NO. C30507
FMVSS NO. 216

FIGURE 5.11
LVDT DISPLACEMENT MOUNTING TO ROOF



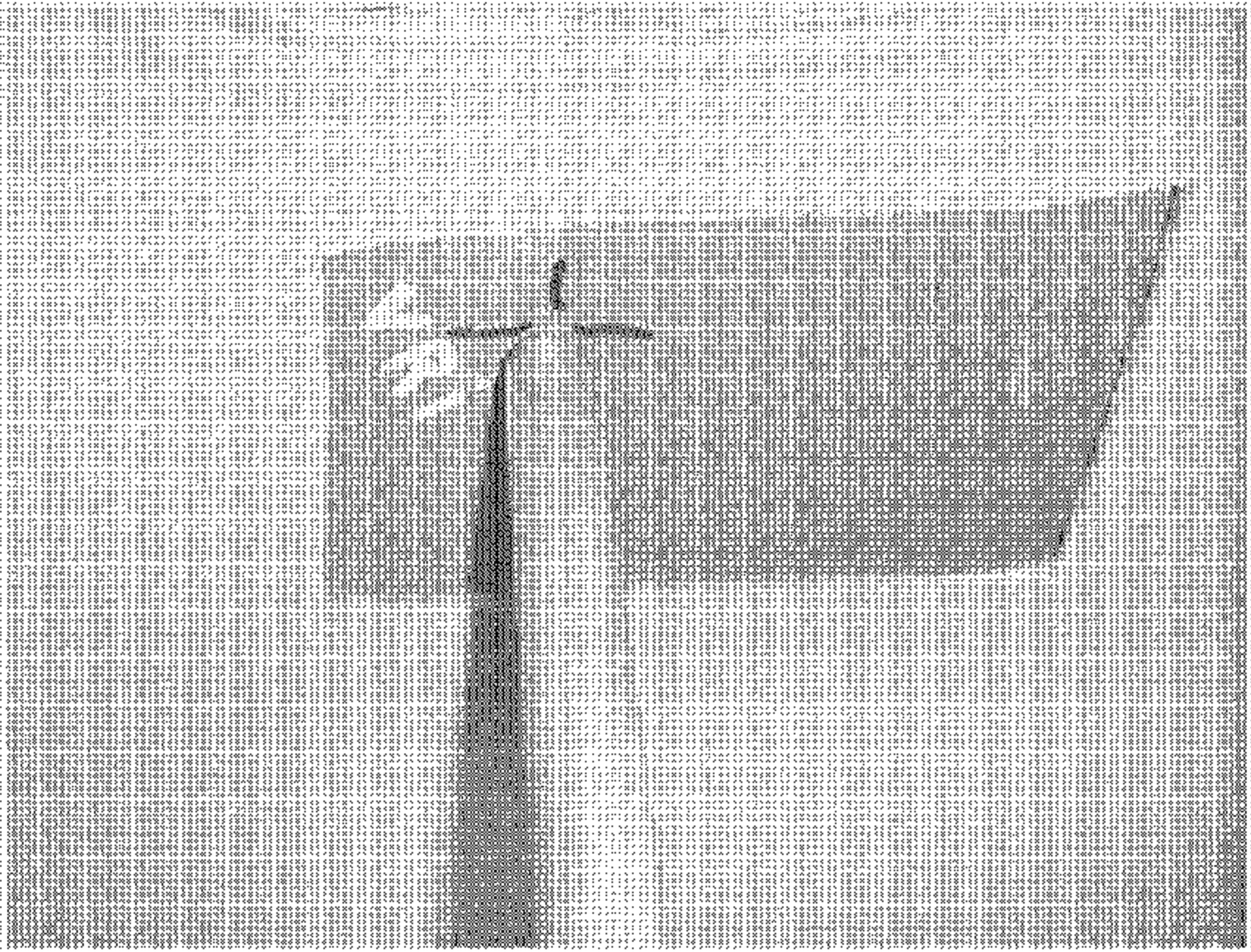
2005 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 5-12
LVDT TRANSDUCER MOUNTING ATTACH POINT



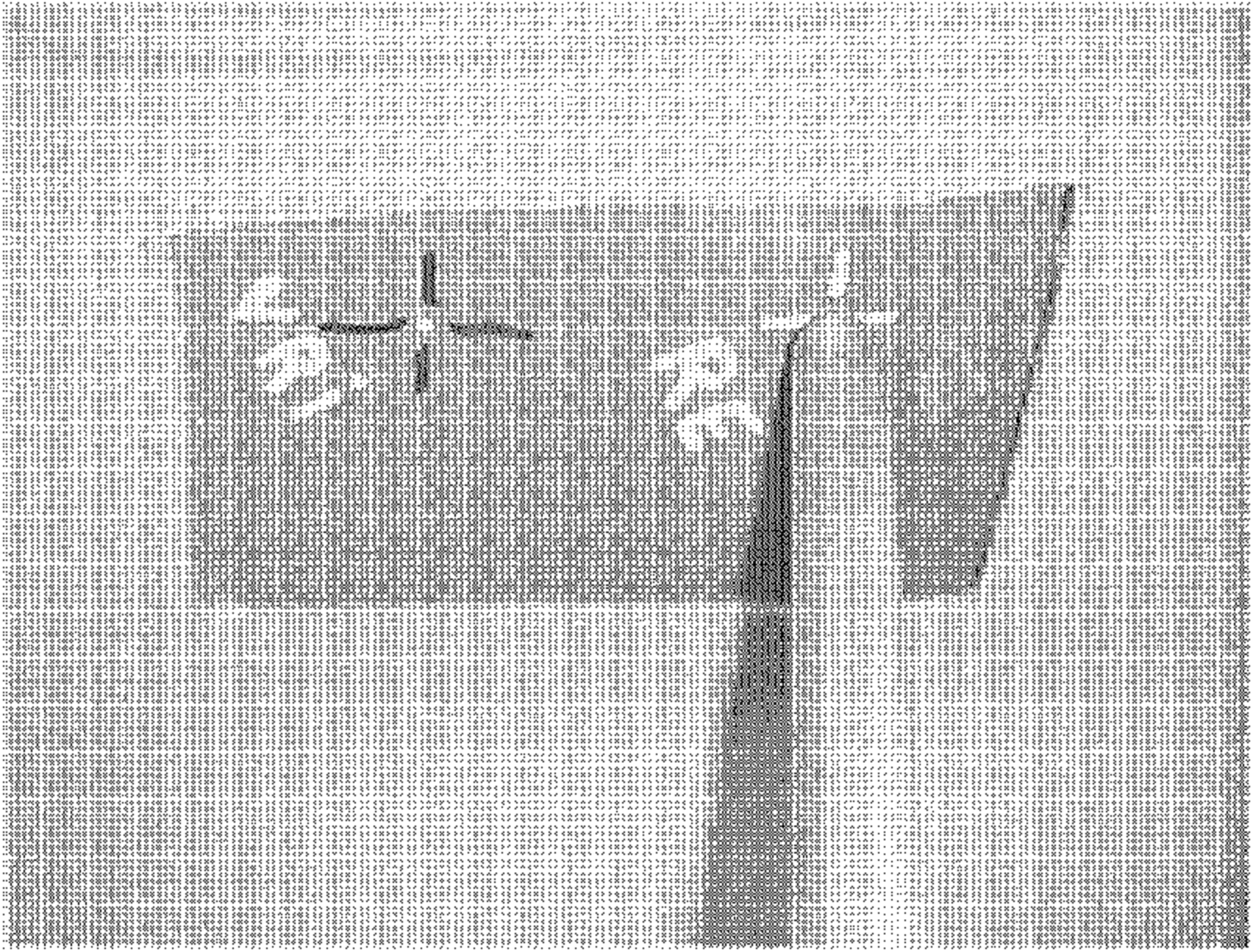
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 5.13
VIEW SHOWING MEASUREMENT OF VRL



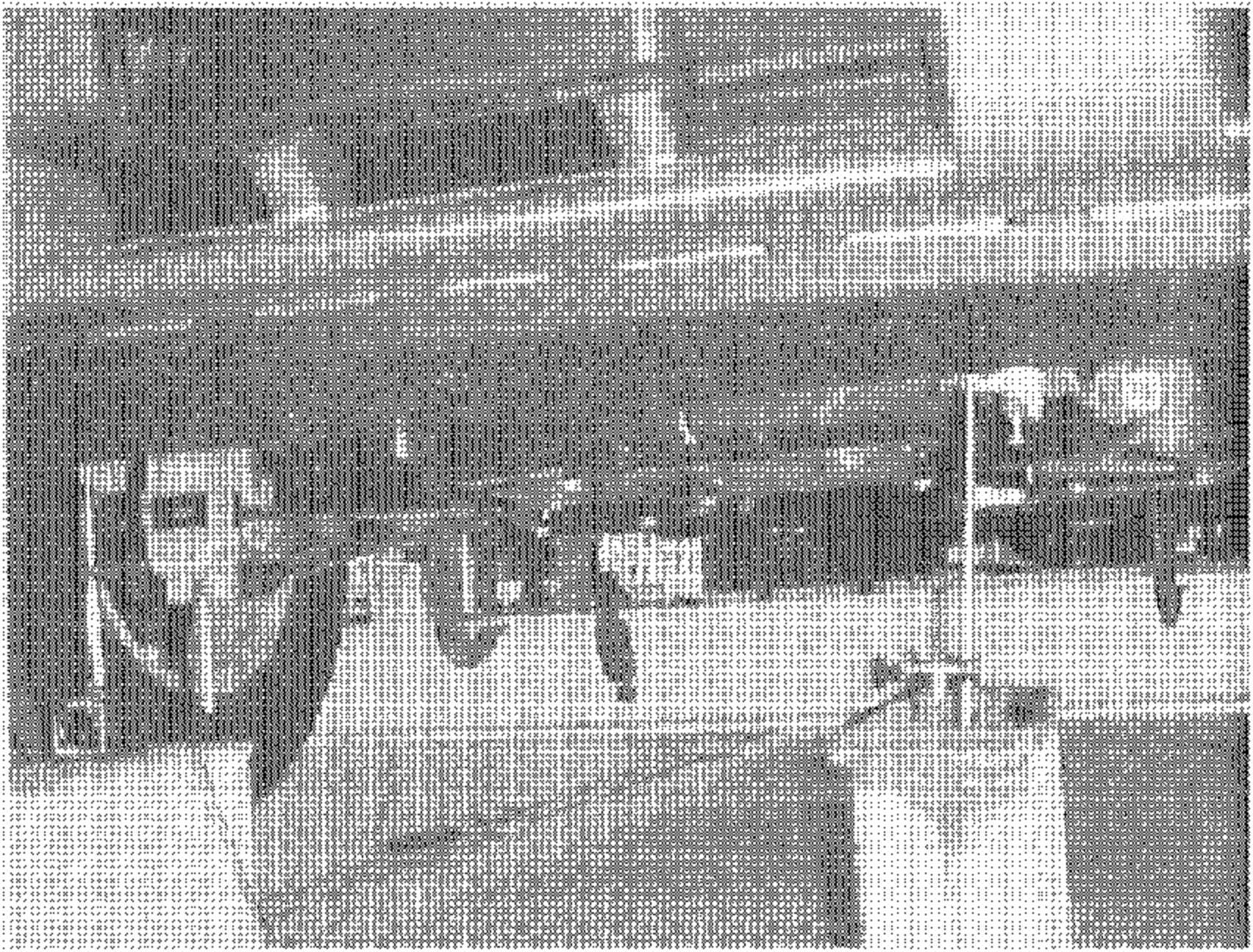
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C20107
FMVSS NO. 216

FIGURE 5-14
VIEW SHOWING MEASUREMENT OF VRI



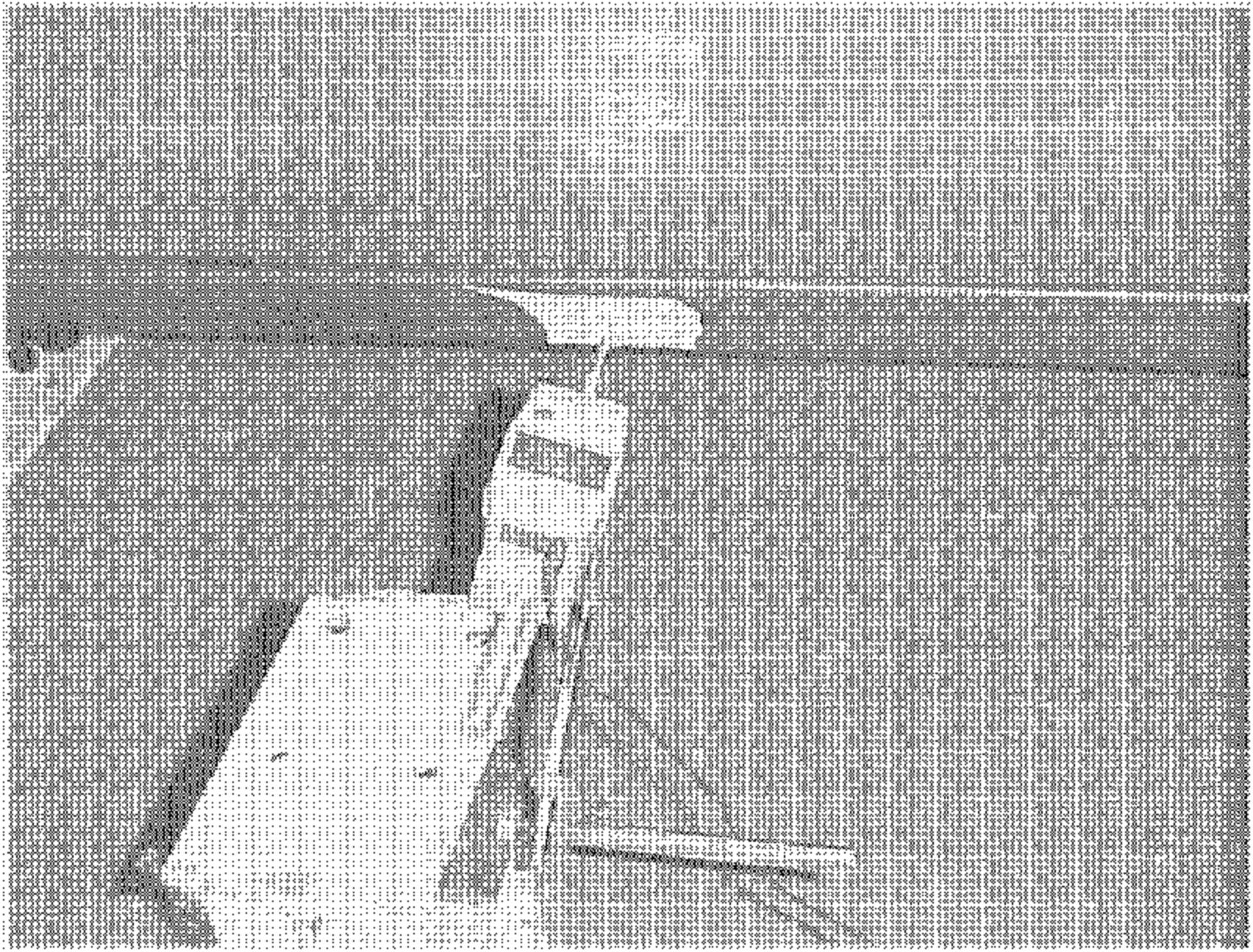
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 5-15
VIEW SHOWING MEASUREMENT OF RE



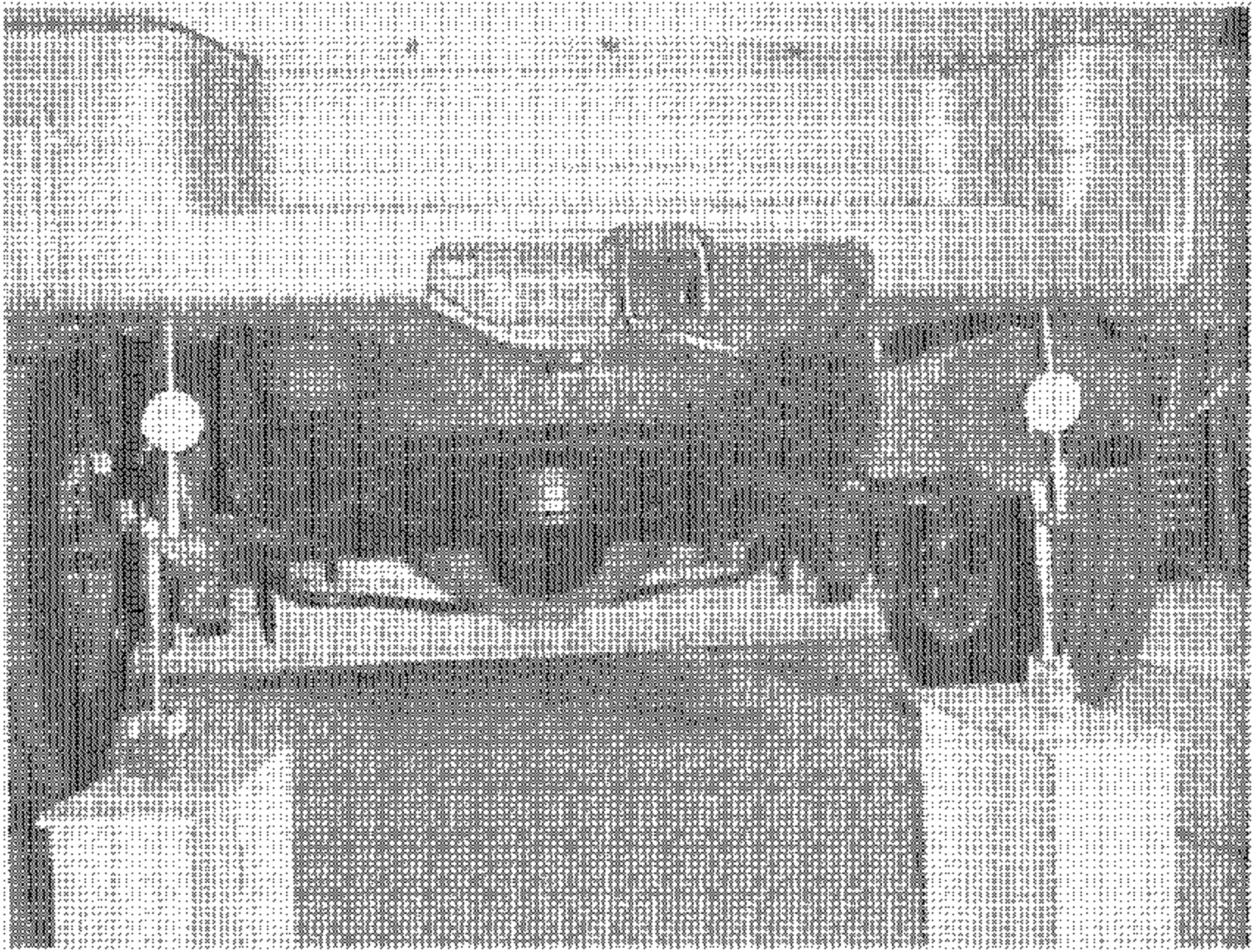
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C20107
FMVSS NO. 216

FIGURE 5-16
DISPLACEMENT INDICATORS AT FRONT OF VEHICLE



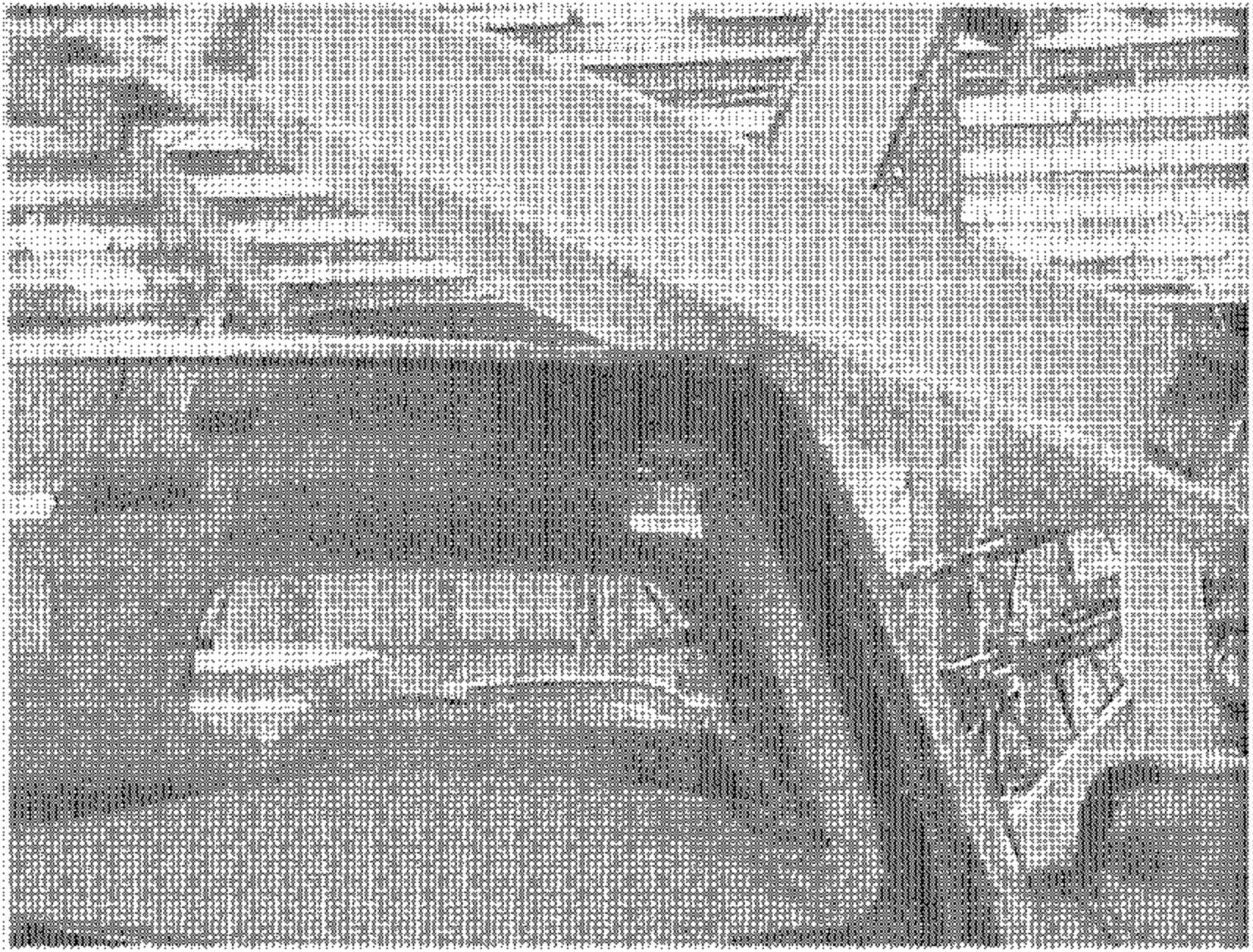
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 3-17
DISPLACEMENT INDICATORS AT PASSENGER DOOR SILL



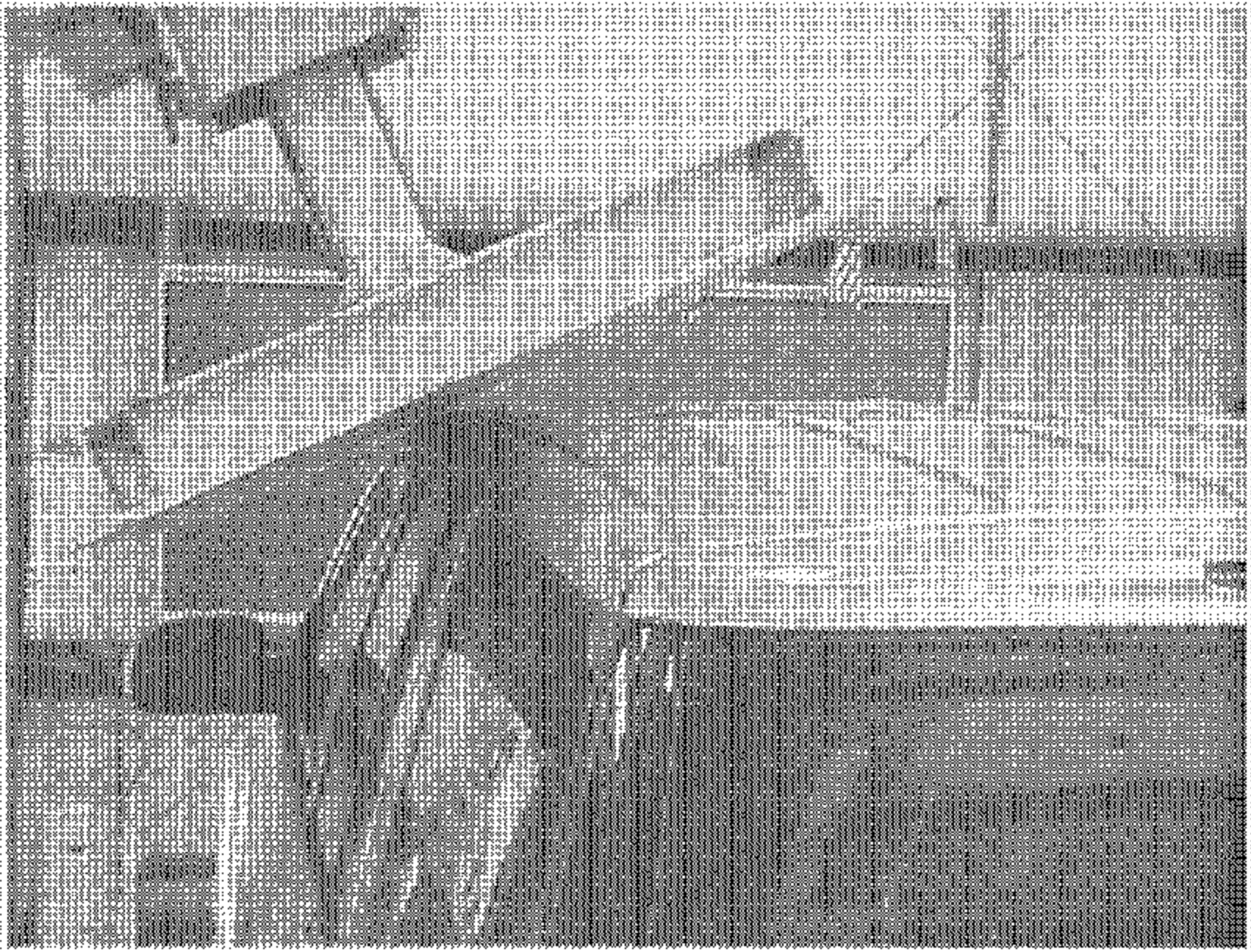
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 5-18
DISPLACEMENT INDICATORS AT REAR OF VEHICLE



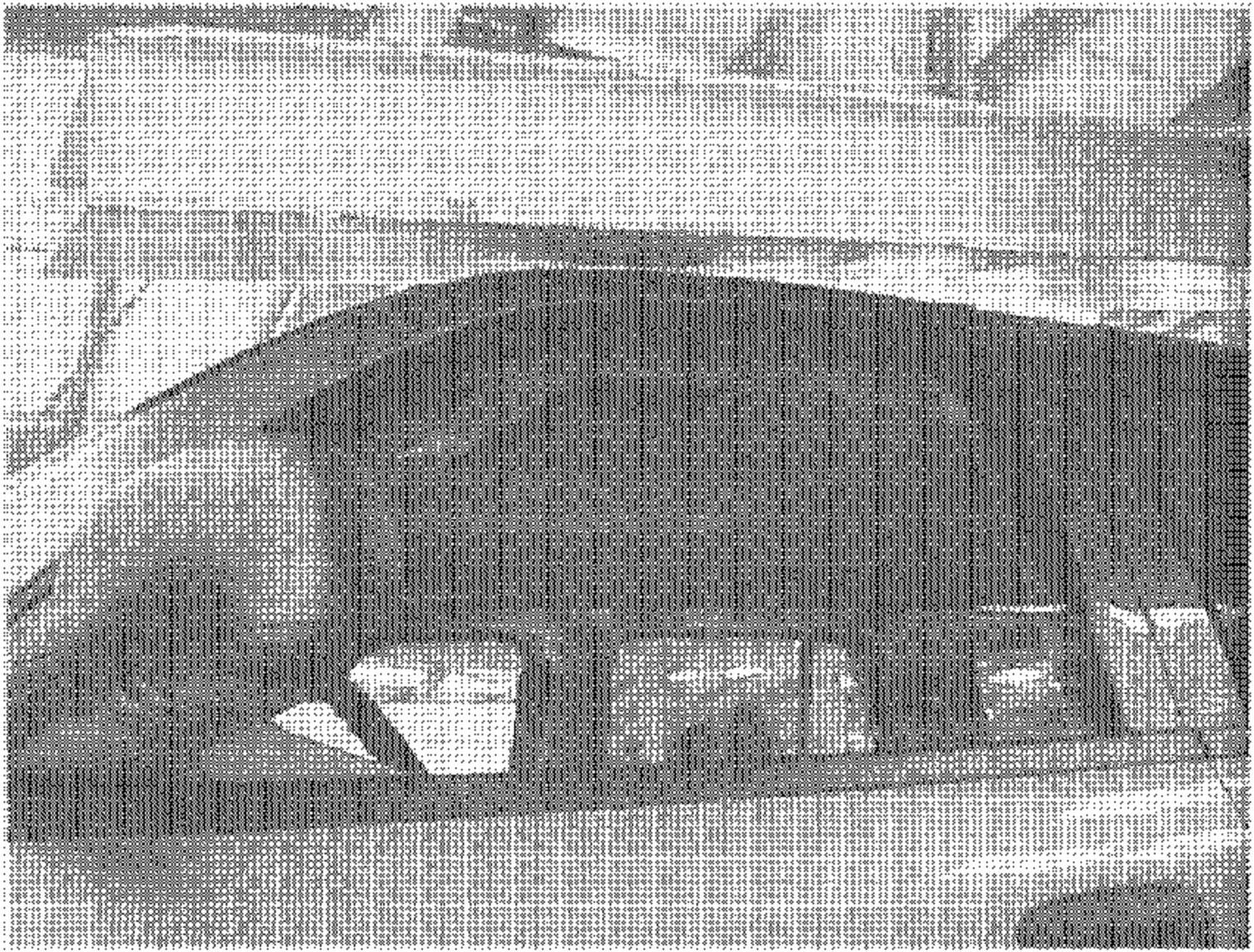
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C3D107
FMVSS NO. 216

FIGURE 3-15
FRONT VIEW OF LOADING DEVICE PLACED AGAINST VEHICLE ROOF



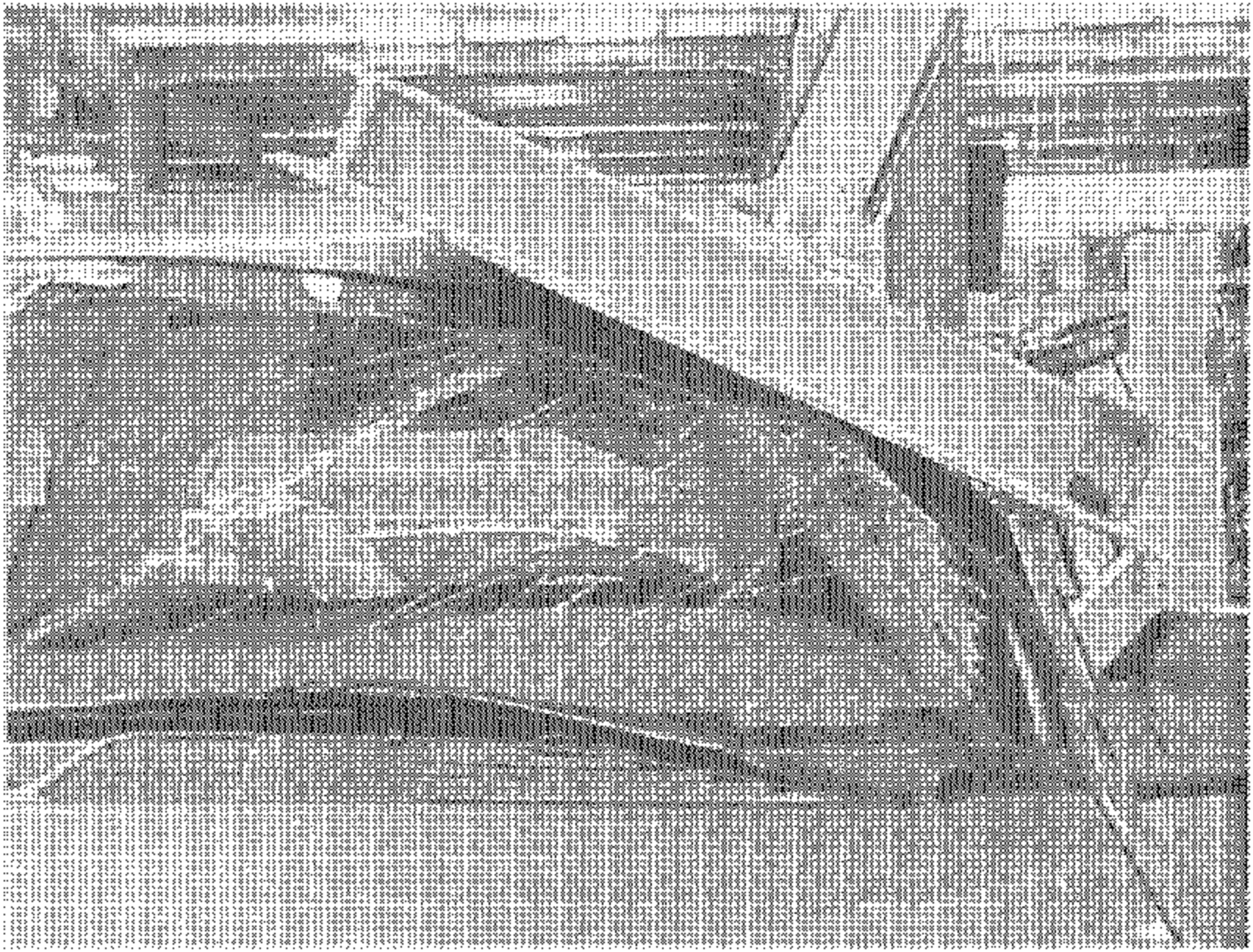
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C20107
FMVSS NO. 216

FIGURE 5.20
REAR VIEW OF LOADING DEVICE PLACED AGAINST VEHICLE ROOF



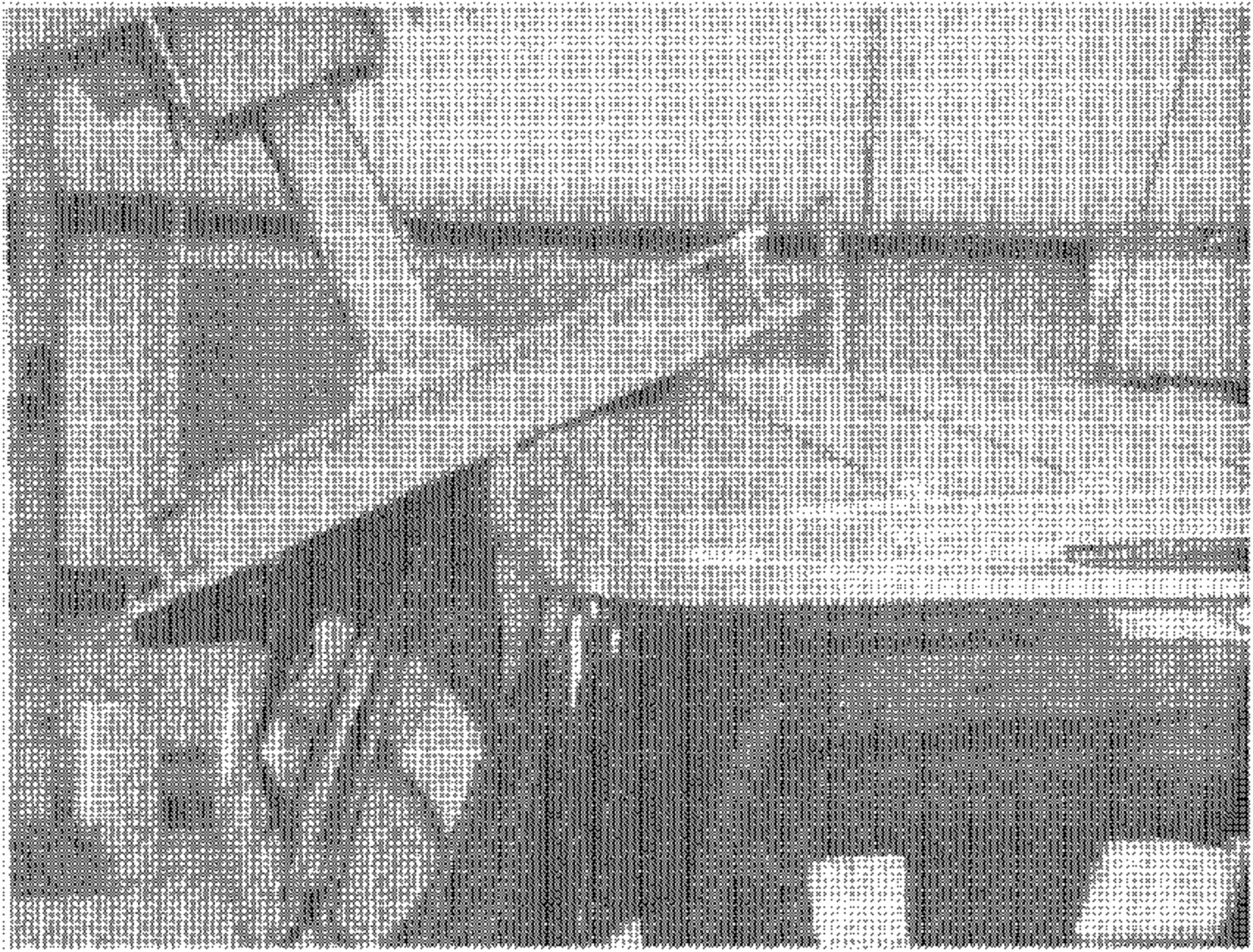
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 5.21
SIDE VIEW OF LOADING DEVICE PLACED AGAINST VEHICLE ROOF



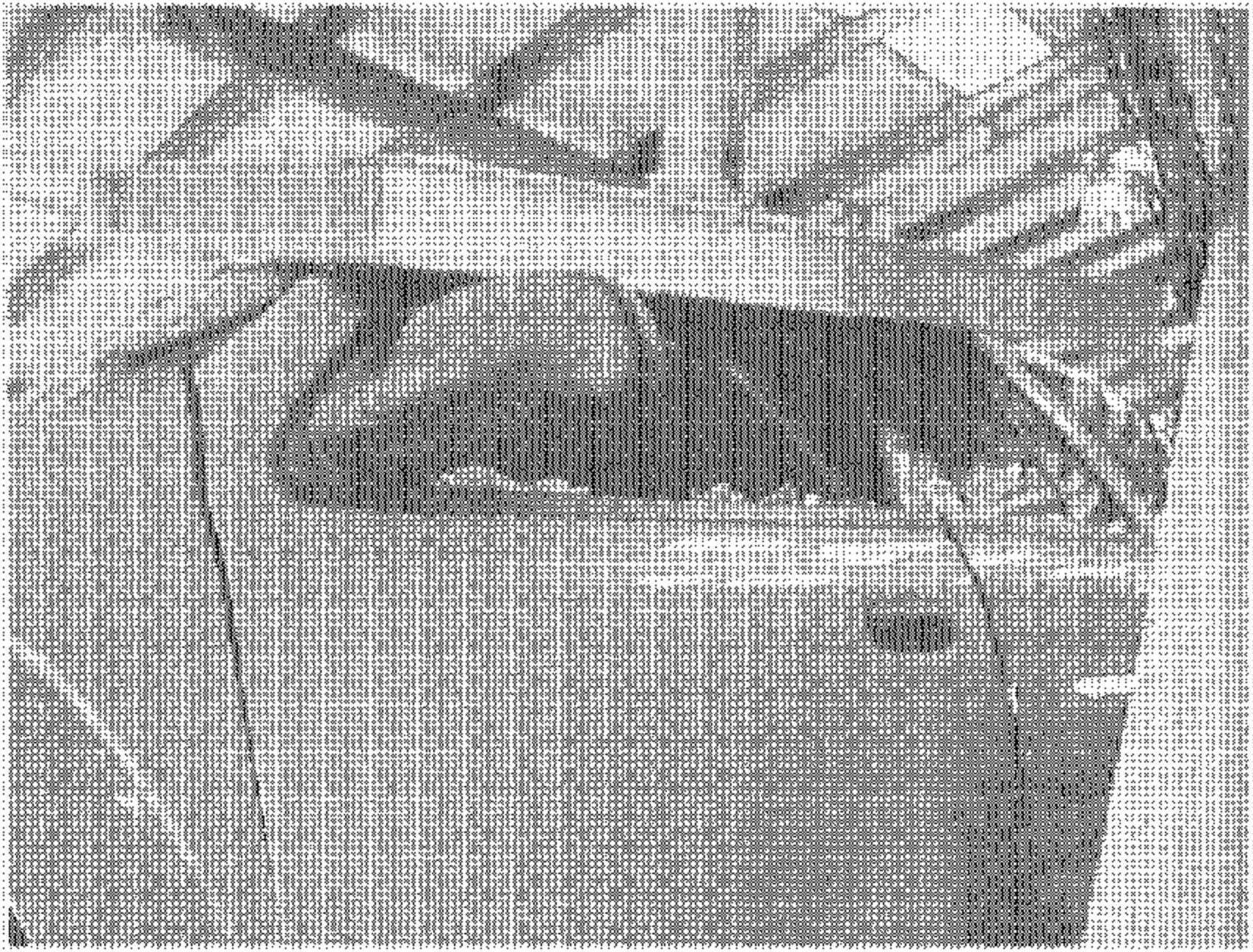
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 5.22
FRONT VIEW OF LOADING DEVICE PLACED AGAINST VEHICLE ROOF AT FULL LOAD



2003 CHEVROLET TRAILBLAZER
NHTSA NO. D20107
FMVSS NO. 216

FIGURE 3.23
REAR VIEW OF LOADING DEVICE PLACED AGAINST VEHICLE ROOF AT FULL LOAD



2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30167
FMVSS NO. 216

FIGURE 8.24
SIDE VIEW OF LOADING DEVICE PLACED AGAINST VEHICLE ROOF AT FULL LOAD

2003 CHEVROLET TRAILBLAZER
NHTSA NO. C20107
FMVSS NO. 216

FIGURE 3-25
¾ FORWARD VIEW OF VEHICLE ON TESTED SIDE AFTER TESTING

2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 214

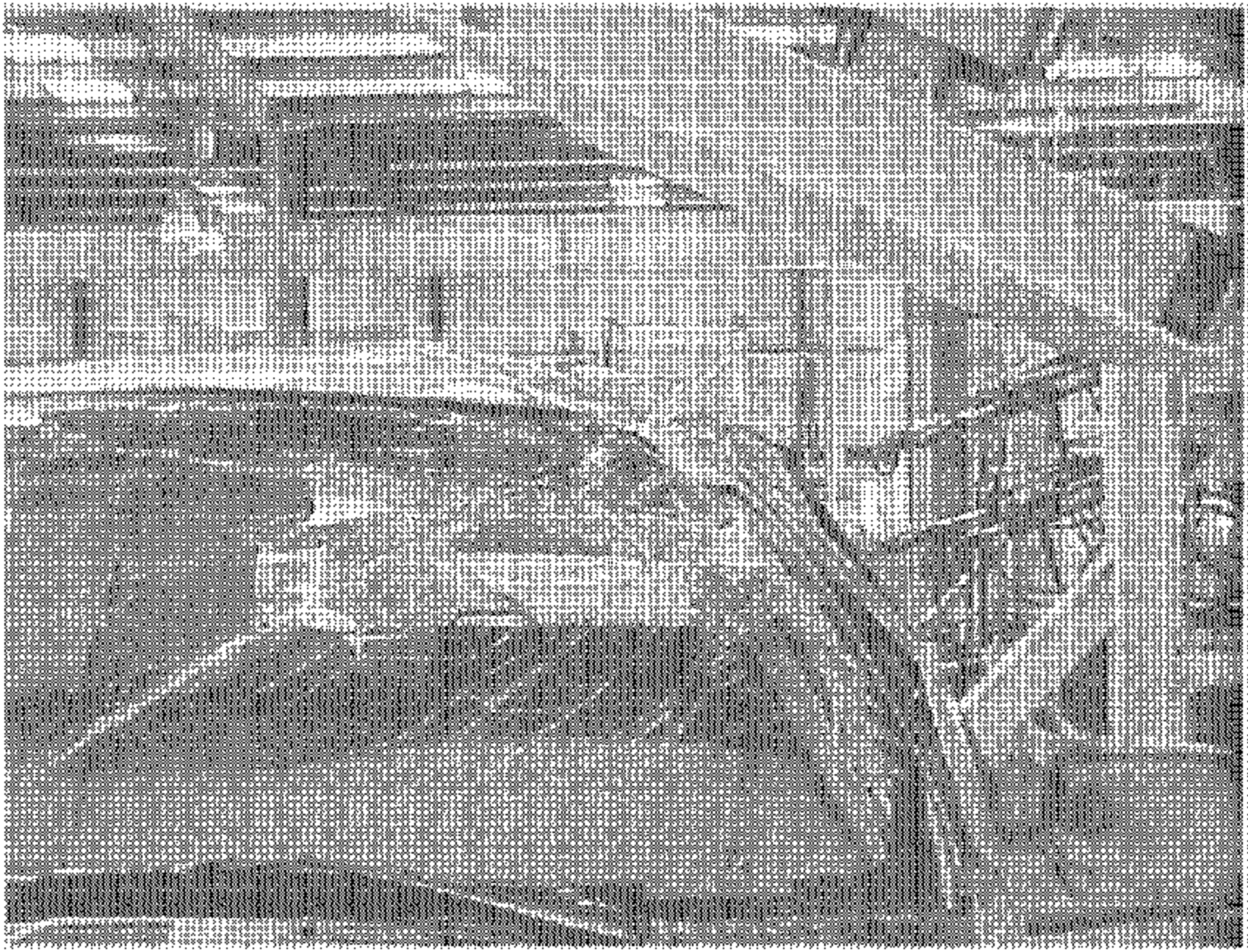
FIGURE 5.26
¾ REARWARD VIEW OF VEHICLE ON TESTED SIDE AFTER TESTING

2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 3-27
LEFT SIDE VIEW OF VEHICLE AFTER TESTING

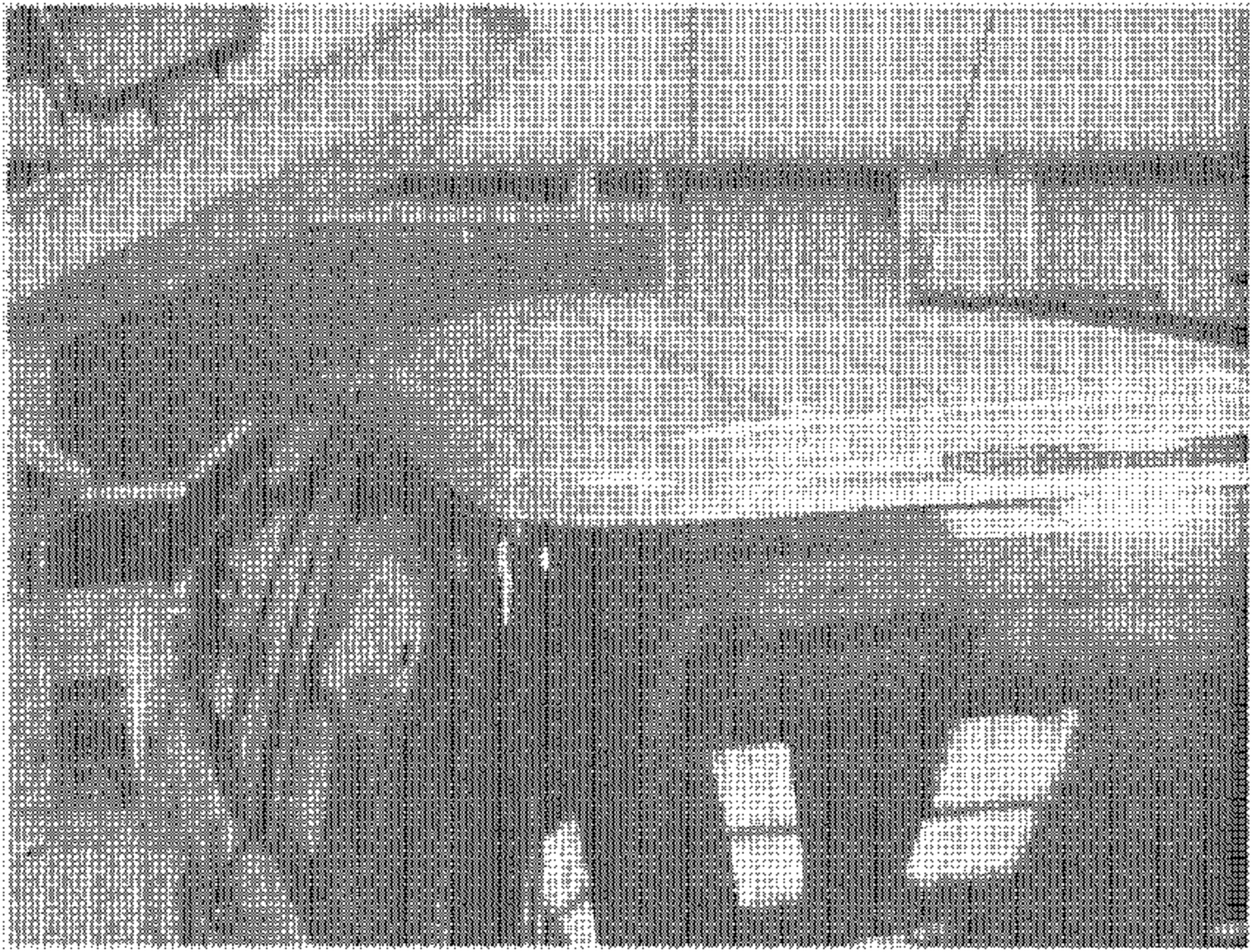
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C22107
FMVSS NO. 216

FIGURE 6.29
RIGHT SIDE VIEW OF VEHICLE AFTER TESTING



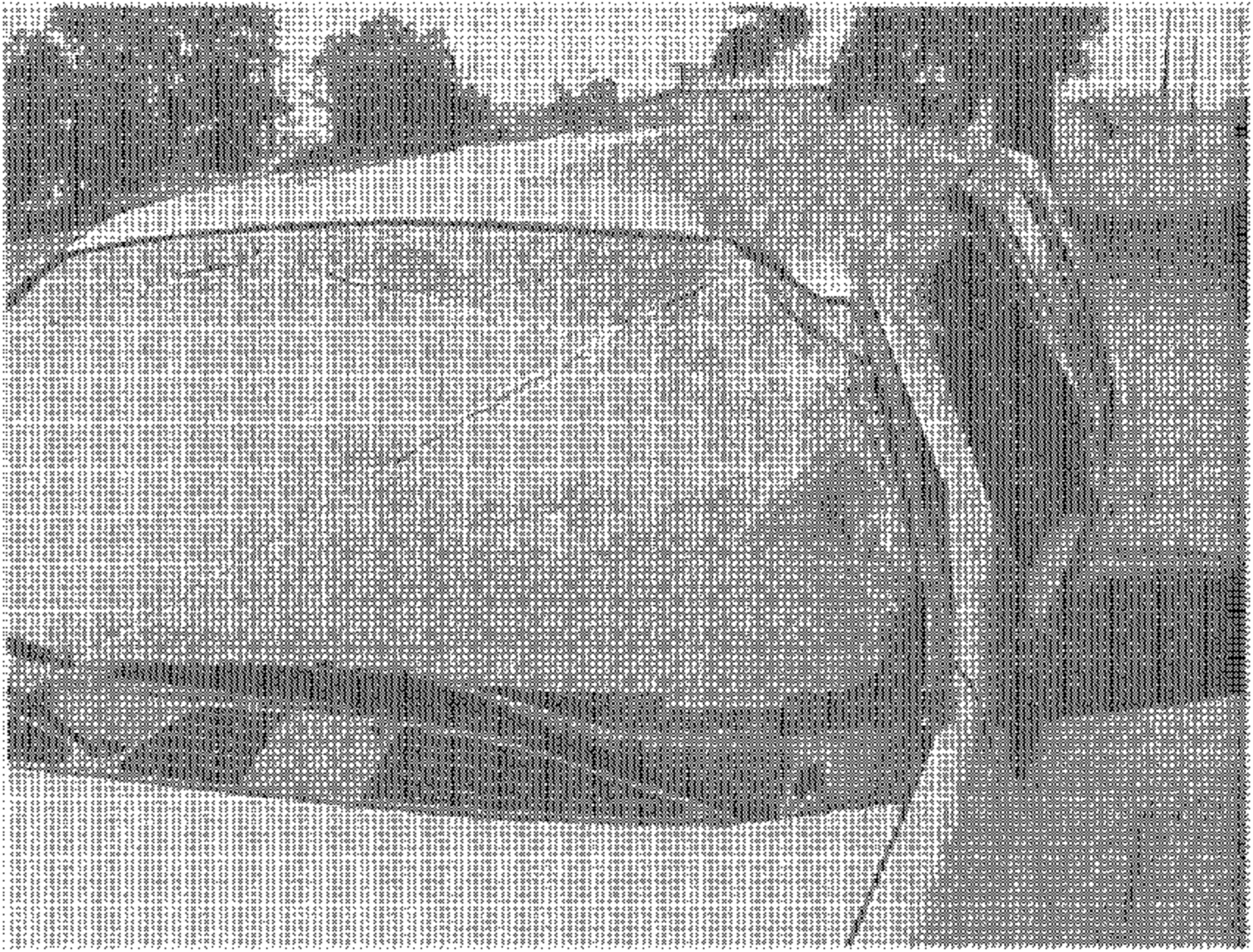
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30157
FMVSS NO. 216

FIGURE 5.29
FRONT VIEW OF VEHICLE ROOF AFTER
REMOVAL OF LOADING DEVICE



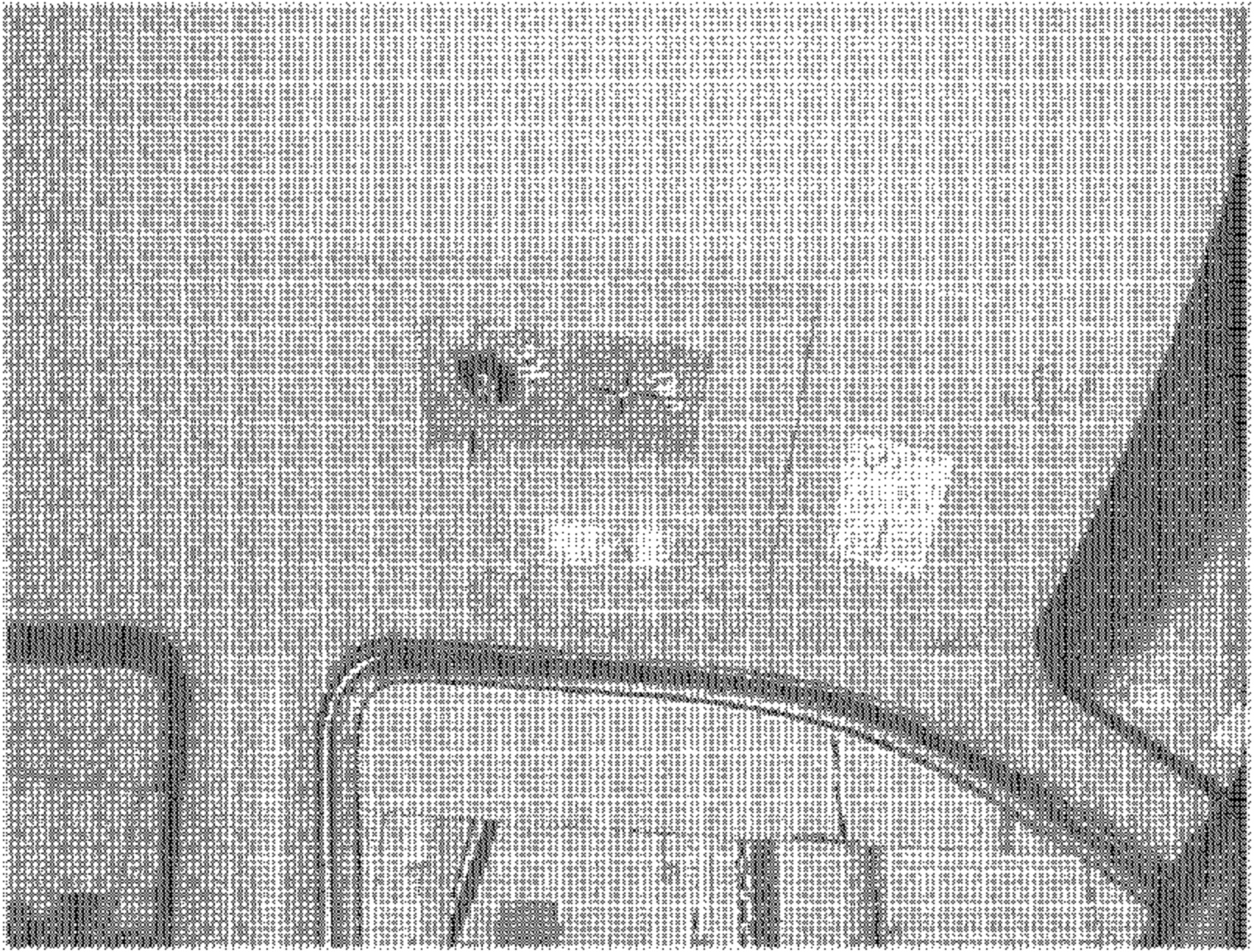
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 3-30
REAR VIEW OF VEHICLE ROOF AFTER
REMOVAL OF LOADING DEVICE



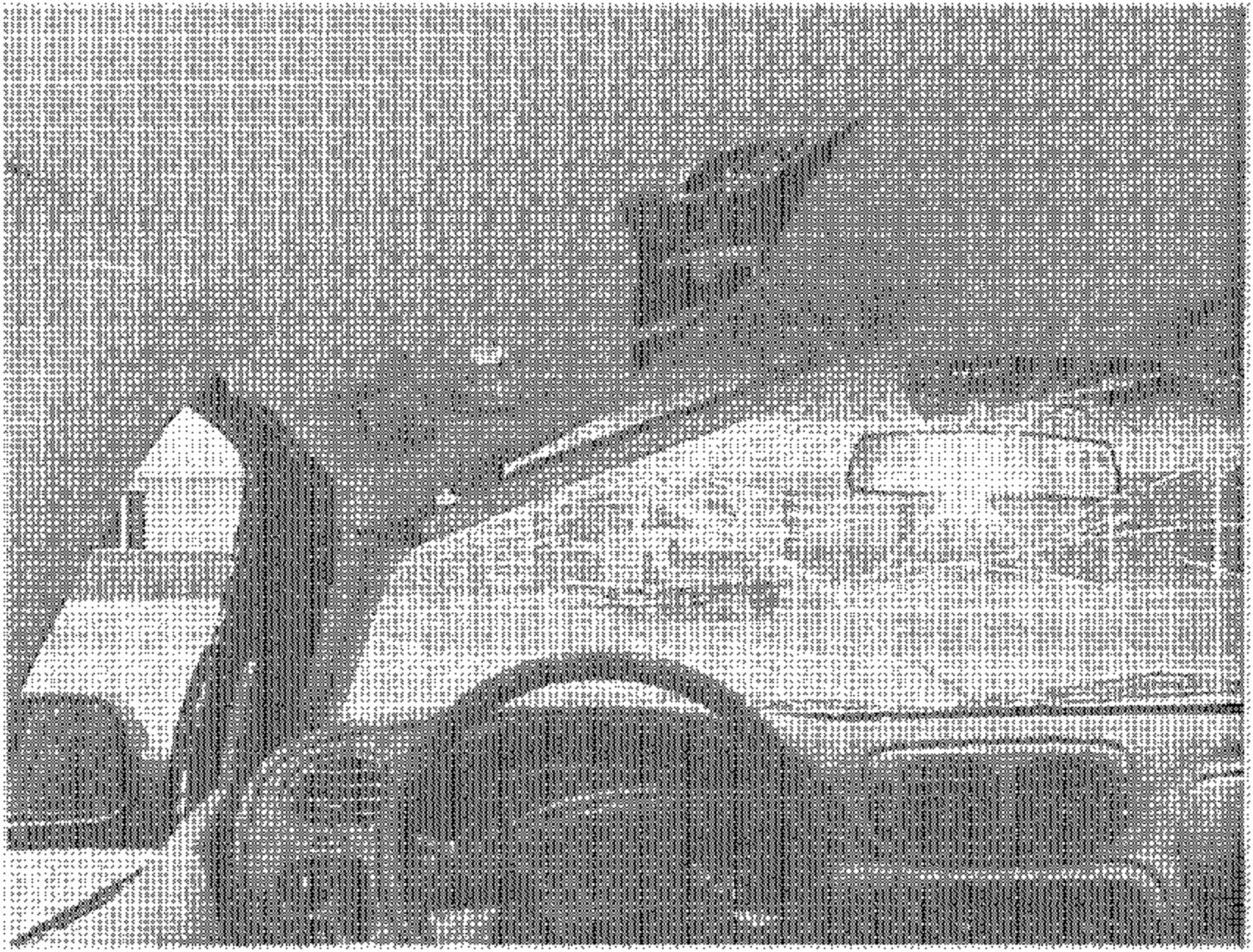
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 216

FIGURE 5-31
CLOSE-UP VIEW OF ROOF POST TEST



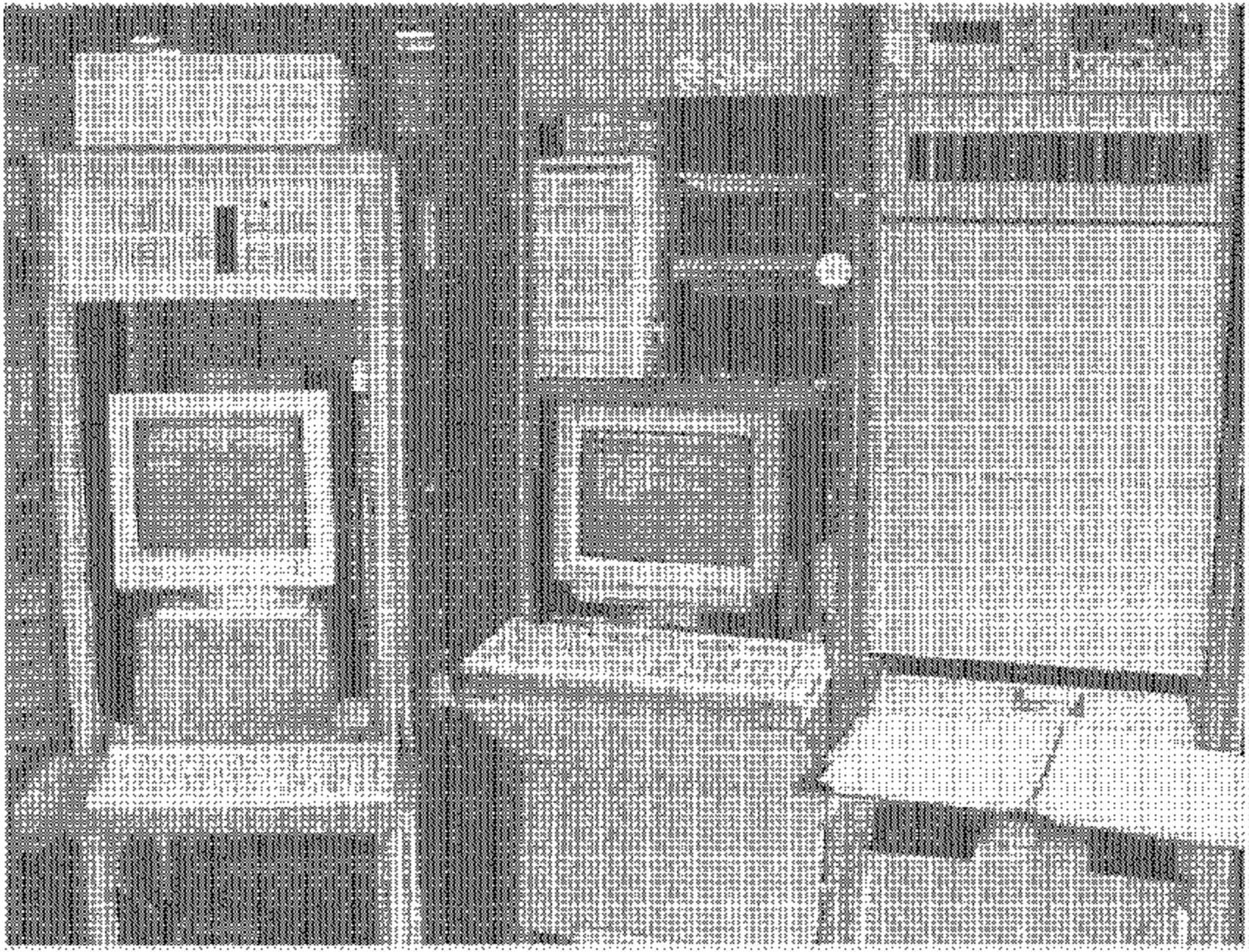
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C00107
FMVSS NO. 216

FIGURE 5.52
INTERIOR VIEW OF ROOF PRETEST



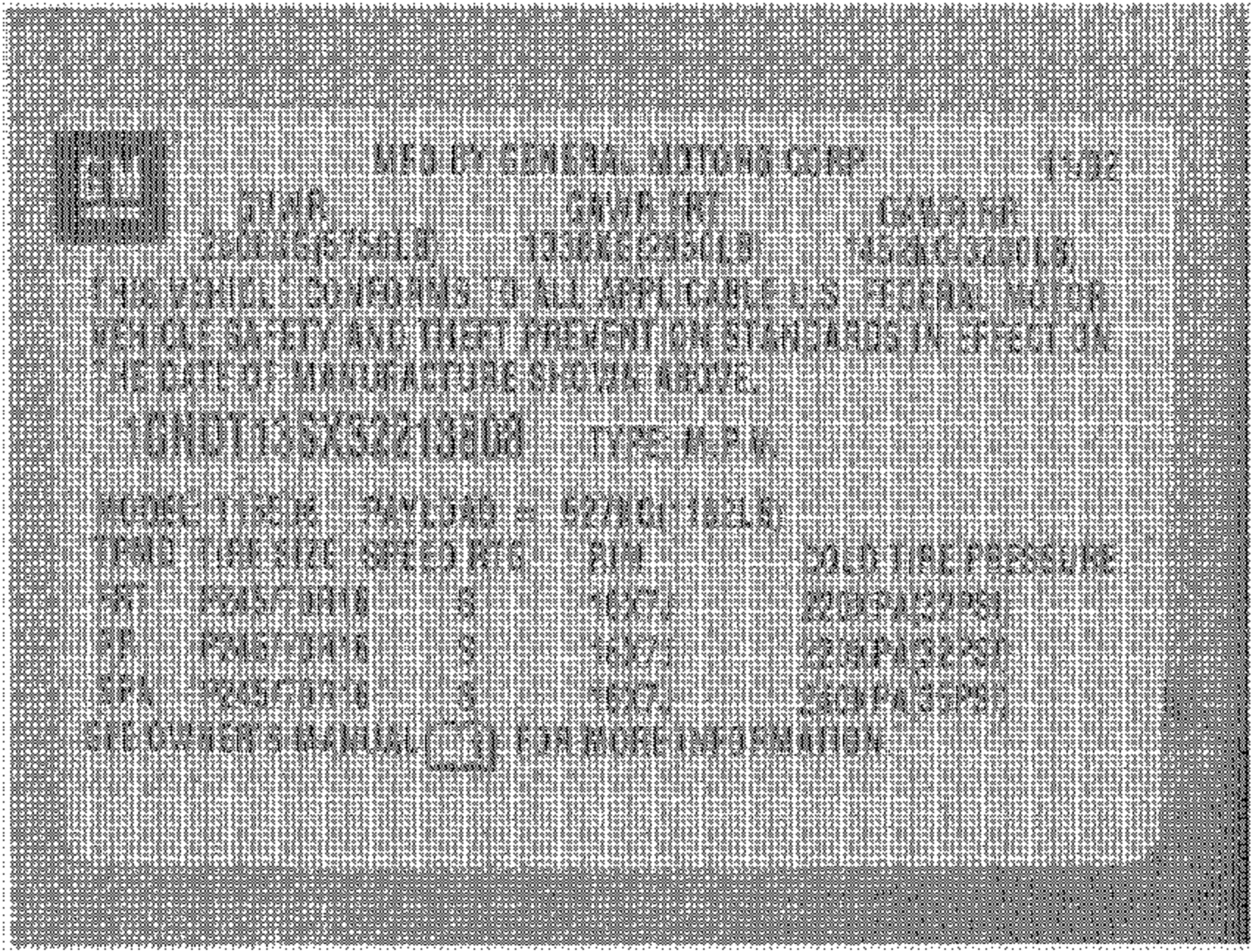
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C0010
FMVSS NO. 216

FIGURE 635
INTERIOR VIEW OF ROOF (POST TEST)



2001 CHEVROLET TRAILBLAZER
NHTSA NO. C30107
FMVSS NO. 219

FIGURE 5.34
INSTRUMENTATION SET-UP

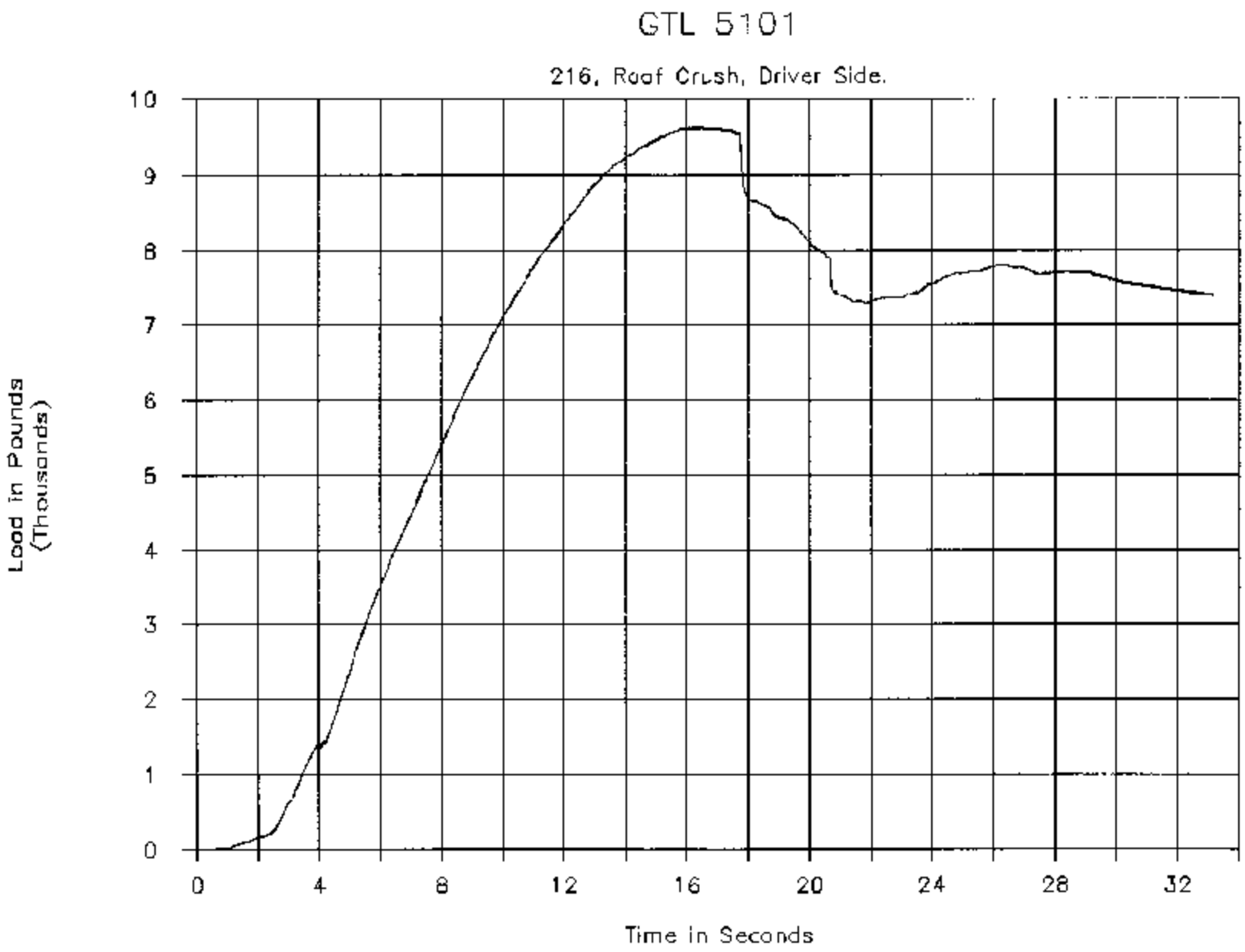


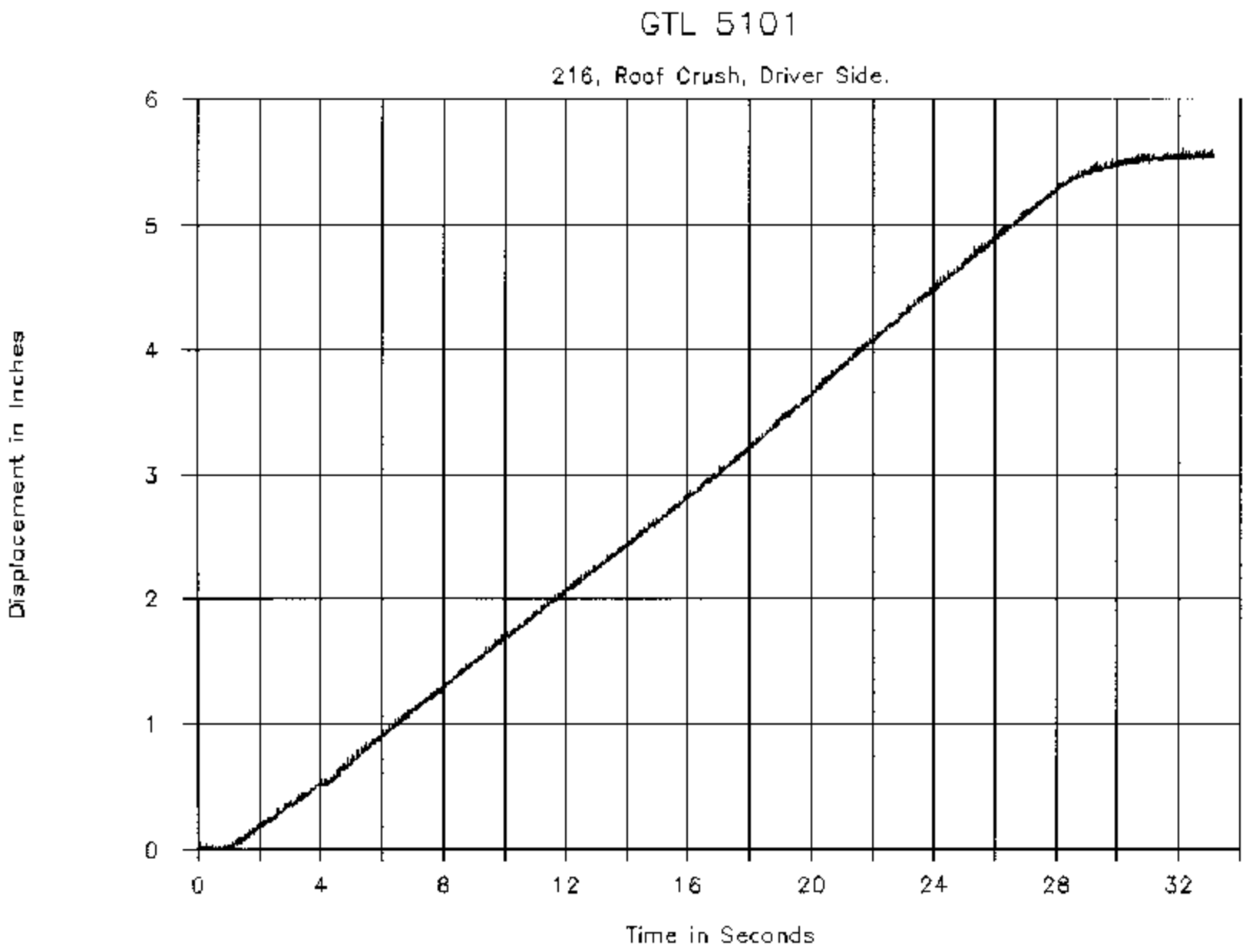
2003 CHEVROLET TRAILBLAZER
NHTSA NO. C30187
FMVSS NO. 216

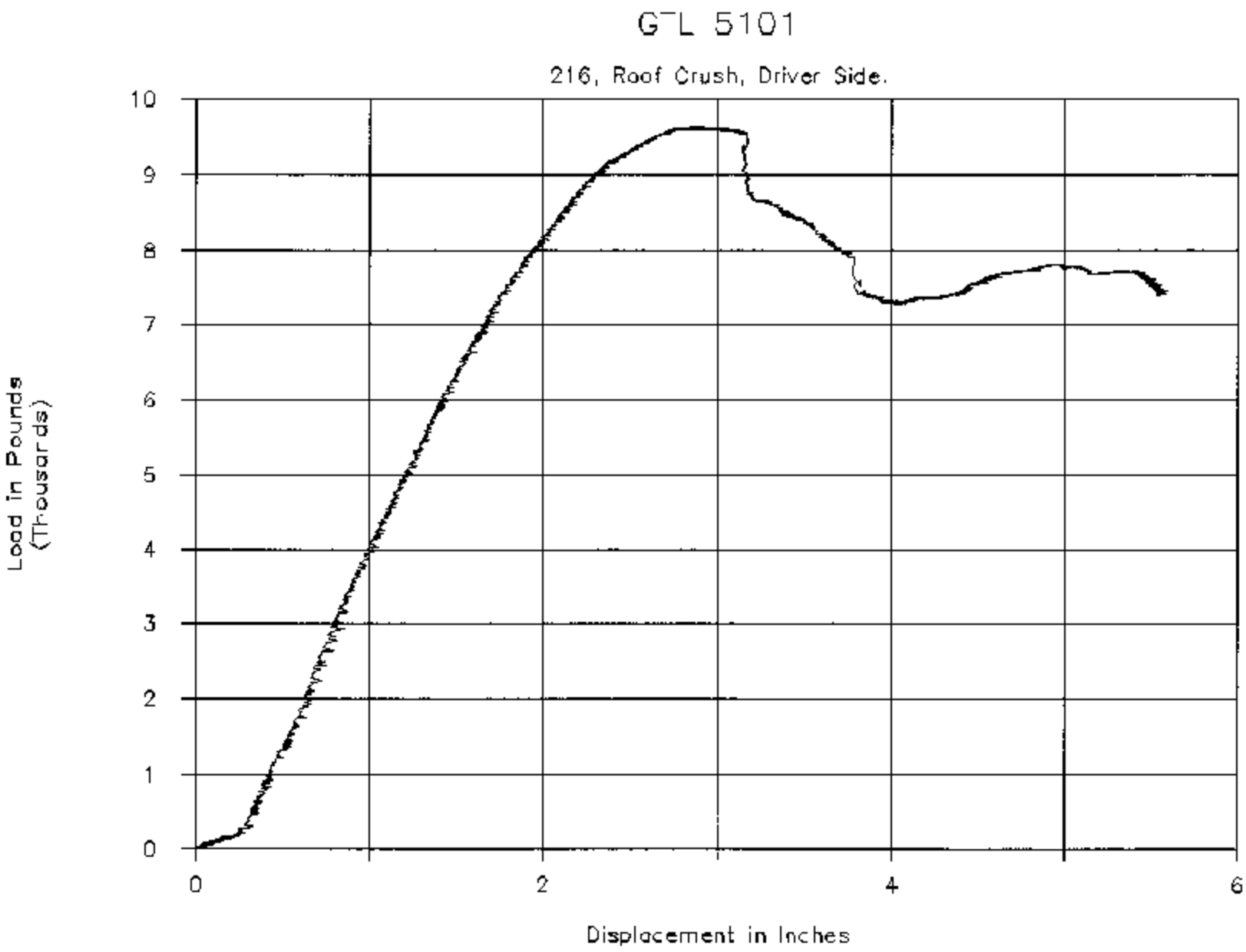
FIGURE 535
CLOSE-UP VIEW OF VEHICLE CERTIFICATION
AND TIRE INFORMATION LABEL

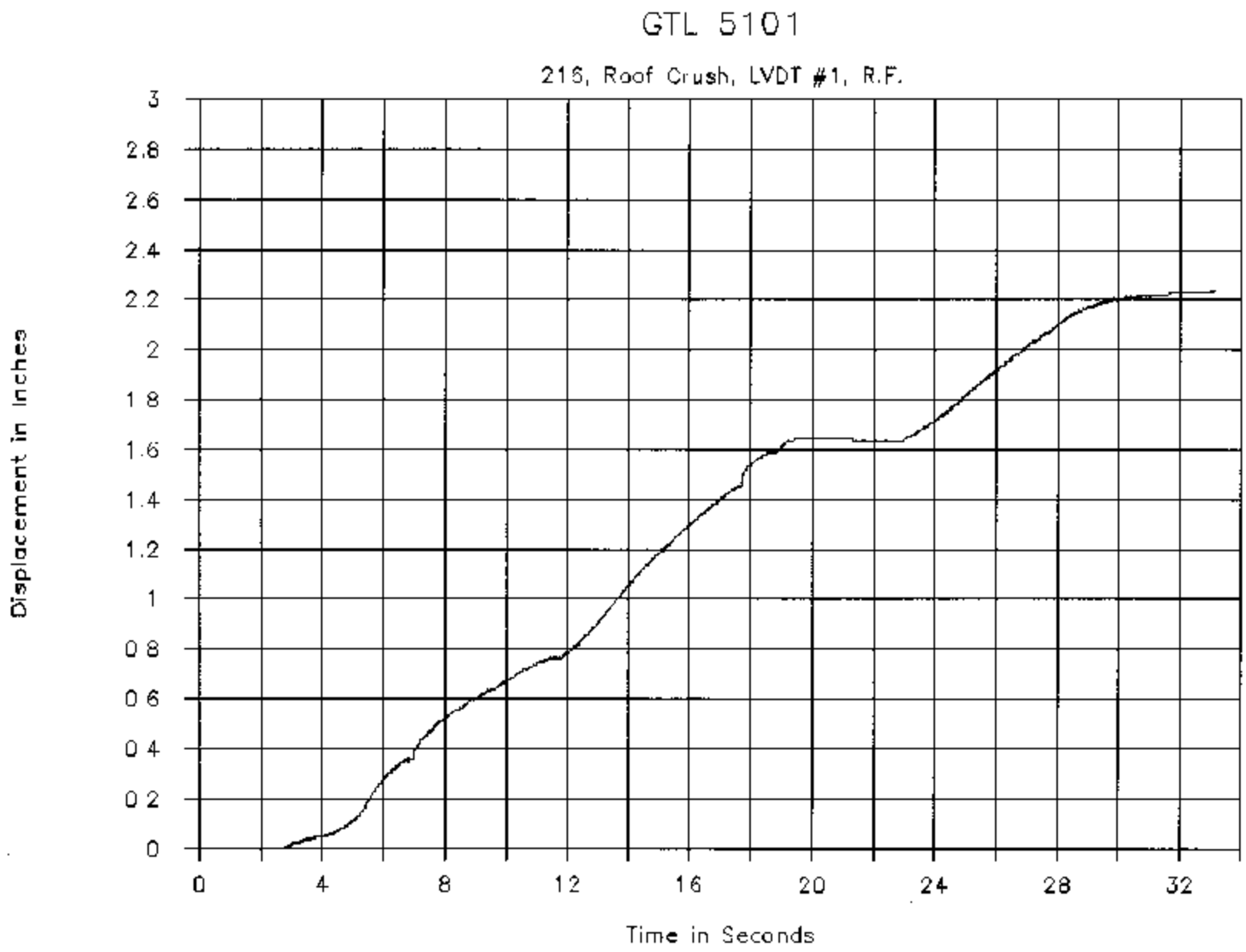
SECTION 6

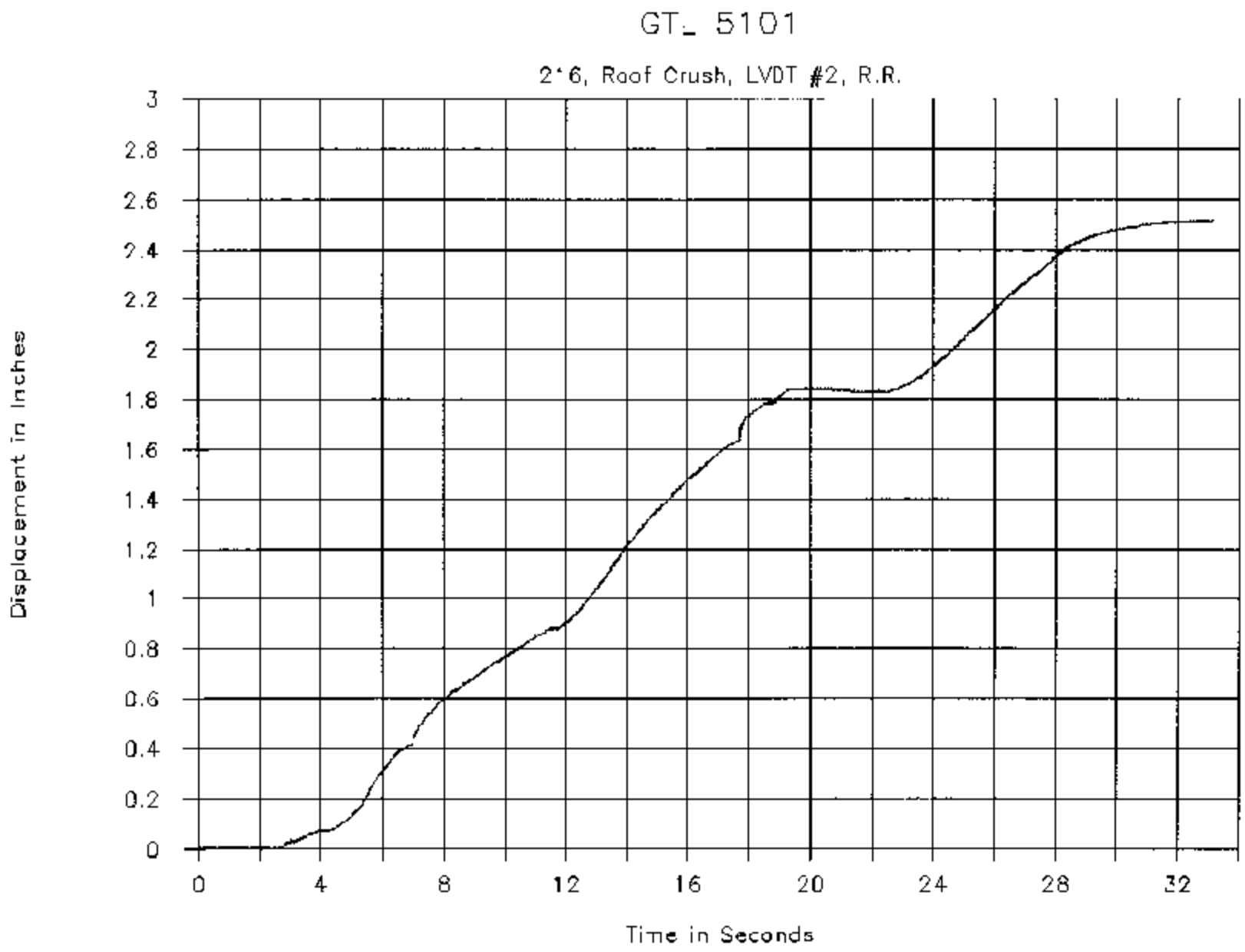
TEST PLOTS

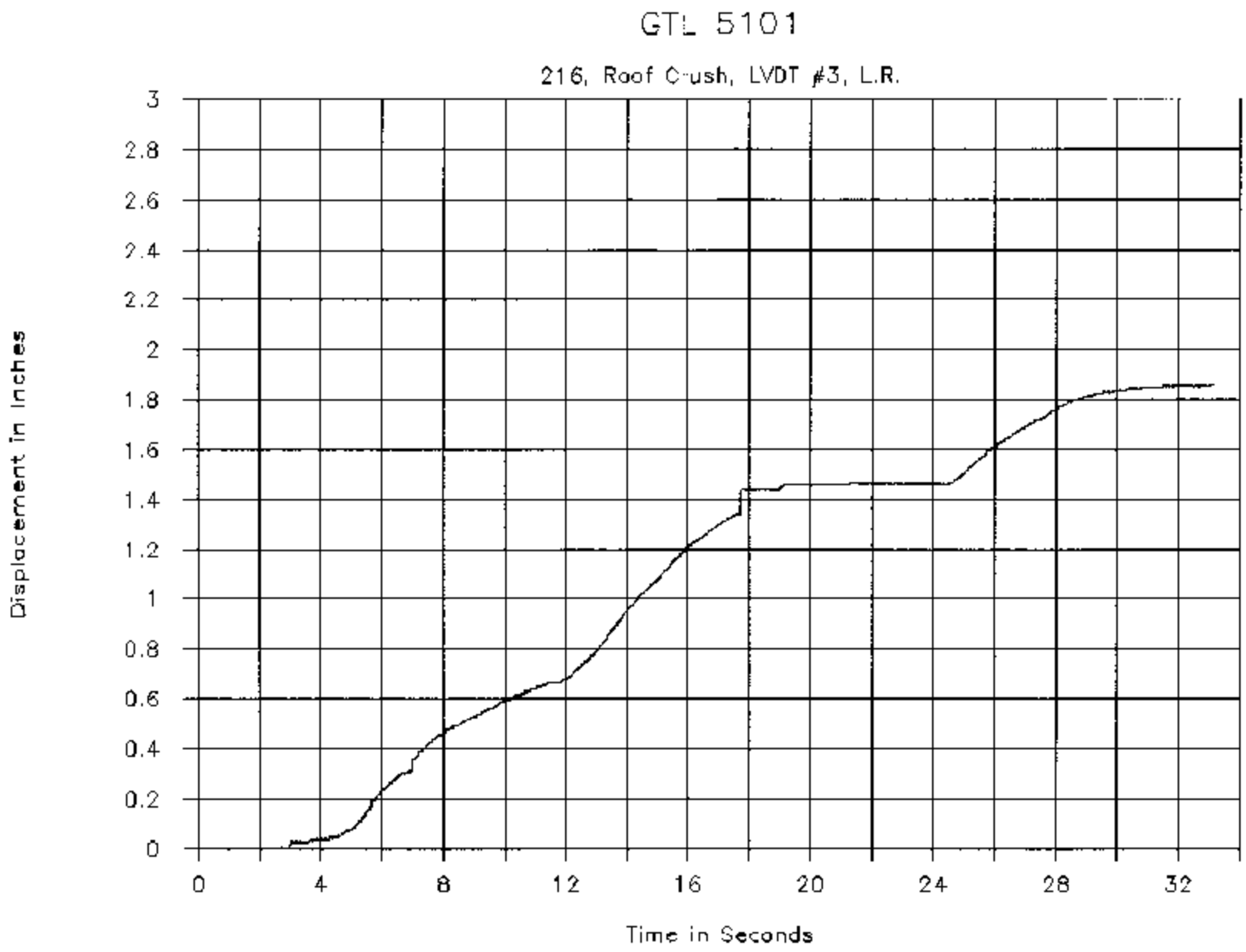

GTL 5101
216, Roof Crush, Driver Side.
Load in Pounds
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
0
4
8
12
16
20
24
28
32
Time in Seconds


GTL 5101
216, Roof Crush, Driver Side.
Displacement in Inches
0
1
2
3
4
5
6
0
4
8
12
16
20
24
28
32
Time in Seconds


G-L 5101
216, Roof Crush, Driver Side.
Load in Pounds
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
0
2
4
6
Displacement in Inches


GTL 5101
216, Roof Crush, LVDT #1, R.F.
Displacement in Inches
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
4
8
12
16
20
24
28
32
Time in Seconds


GT_ 5101
2'6, Roof Crush, LVDT #2, R.R.
Displacement in Inches
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
4
8
12
16
20
24
28
32
Time in Seconds


GTL 5101
216, Roof Crush, LVDT #3, L.R.
Displacement in Inches
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
4
8
12
16
20
24
28
32
Time in Seconds